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The Significance of Giant Follicular Lymphadenopathy

(Brill-Symmers Disease)[1]

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THE CONDITION known as giant follicular lymphadenopathy and associated with the names of Brill and Symmers, is a disease of the lymph nodes which has attracted increasing attention during the past few years. It seems that this disease, while not uncommon, is still little known among the medical profession in general, and often is not correctly interpreted by pathologists; it offers many challenging aspects to the internist, the surgeon, the hematologist, the pathologist, and the radiotherapist. As aptly described clinically and histologically by Brill, Baehr, and Rosenthal in 1925, giant follicular lymphadenopathy is a well defined disease entity which may eventually be followed by or transformed into lymphatic leukemia, polymorphous-cell sarcoma, or Hodgkin's disease.

The first observation of symptoms apparently belonging to this group was published in 1901 by Becker, who used the term "pseudo-leukemia" to describe his findings. Symmers created the term "giant follicular lymphadenopathy" when he published his observations in 1927. Other papers have been published since that time, mostly by the same groups of men, calling attention to one or another phase of the disease. Generally speaking, however, it is still unusual for the correct diagnosis to be made by the general practitioner, internist, radiologist, or even by the hematologist.

In our department, we succeeded in familiarizing ourselves with the clinical and histological findings and were able, within a period of six months, to establish the diagnosis of giant follicular lymphadenopathy in 9 patients who previously had been under observation or treatment for diagnoses such as "atypical sarcoma," "atypical Hodgkin's disease," or "aleukemic leukemia." Before presenting our own cases, a short review of the clinical symptoms seems to be appropriate.

The disease bears a strong resemblance to Hodgkin's disease and in most instances is diagnosed as such. Giant follicular lymphadenopathy is characterized by either localized or generalized enlargement of the superficial lymph nodes, often in conjunction with splenomegaly. The first enlargement seems frequently to be in the lymph nodes of the neck, but there is no preference for any particular site. Lymph node swelling may occur in the supraclavicular fossa, in the axilla, in the groin, or in the abdomen, or may be generalized, involving practically all palpable lymph nodes of the body. The involved nodes are usually rather soft; only very seldom do

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they become hard. Their size may vary from a chain of small lymph nodes to masses as large as a grapefruit, without any regularity. The lymph nodes may remain unchanged in size or configuration for months or even years, but in other instances the occurrence of a single lymph node is quickly followed by generalized lymphadenopathy. The general condition of the patient is usually not influenced to any extent by the lymphadenopathy, even if generalized. Enlargement of the spleen is a rather common feature of the disease. Pain is practically never present, and there are no characteristic alterations in the peripheral blood.

While there is no age limit for giant follicular lymphadenopathy, those in the third and fourth decades seem to be afflicted more frequently than younger or older persons. There is no definite sex preference.

The microscopic findings in the lymph nodes are rather characteristic and should not be mistaken for leukemia, sarcoma, or Hodgkin's disease. In most instances the anatomic structure of the lymph follicles is changed, but not completely destroyed, and for this reason most pathologists, if they are not thoroughly acquainted with the characteristics of this disease, are hesitant to make a diagnosis of a malignant lesion. Chronic lymphadenitis and lymphoid hyperplasia are the most frequent terms used by pathologists to describe the microscopic findings. The histologic changes are comparatively simple, and consist, as Symmers has aptly stated, of numerical and dimensional hyperplasia of the lymph follicles. Frequently, these follicles are difficult to distinguish from the familiar hyperplasia which occurs with innumerable inflammatory conditions, and not uncommonly also with benign and malignant neoplasms. Often the follicles are filled with large hypochromatic or even achromatic nuclei, also called "shadow cells," of various shapes. In some instances the peripheral zone of small lymphocytes is absent, while in others the follicles may be made up exclusively of small lymphocytes. As long as these cells remain localized within the lymph follicles, the disease must be diagnosed as giant follicular lymphadenopathy, but rupture of the follicles with escape of the cells into the surrounding tissues of the lymph node is usually considered to be pathognomonic of polymorphous-cell sarcoma.

It seems that the microscopic picture, as described, may exist for a number of years, simulating a benign lesion from the point of view of the pathologist. As will be demonstrated below, we have seen patients who have repeatedly undergone biopsies of enlarged lymph nodes over a period of as long as five years, still showing the same microscopic findings. While Symmers believes that a spontaneous diminution in the size of the nodes, or a complete disappearance, may occur, we have not noticed such spontaneous disappearance in the patients under our observation. There is no way of determining from the study of the microscopic slides whether the lymph nodes will remain for a short or long time in the same state, or later show changes which must be interpreted either as sarcoma, leukemia, or Hodgkin's disease.

Since 1941, we have observed 22 patients in whom the diagnosis of giant follicular lymphadenopathy could be established. In some of these cases the diagnosis was missed when the patients were first seen and corrected only after periodic follow-up examinations when our suspicions were sufficiently aroused to review the microscopic slides of earlier biopsies. It is probable that a number of other cases which were treated as chronic lymphadenitis should have been classified as giant follicular lymphadenopathy, and that the incidence of the disease is higher than our records indicate.

A short history of the patients seen in our department follows:

CASE 1: B. T., male, aged 40, was first seen on Nov. 22, 1939, for a swelling of a lymph node in the right submaxillary region. This swollen lymph node had been present for six months without change in size or consistency. A biopsy report was

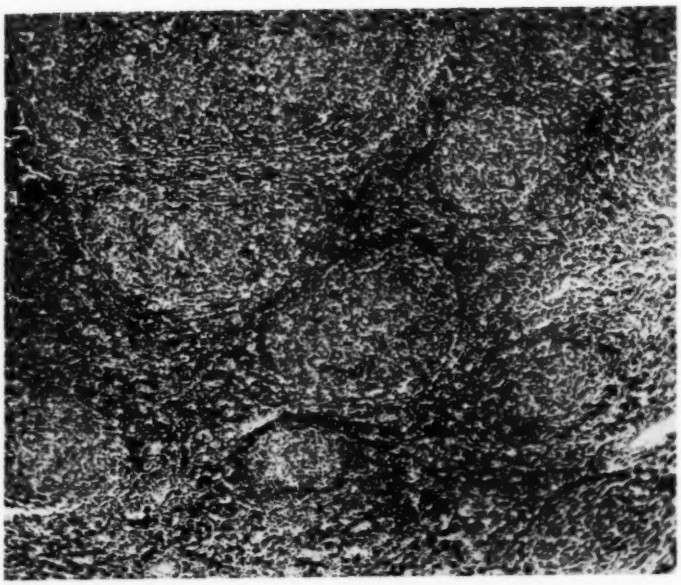

Fig. 1. Enlarged lymph follicles of various shapes and sizes in giant follicular lymphadenopathy.

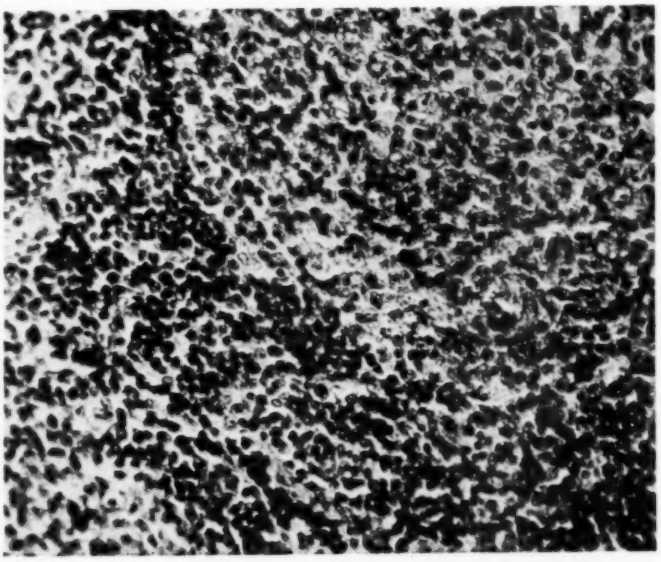

Fig. 2. Lymph follicle with hypochromatic cells in giant follicular lymphadenopathy.

"chronic inflammation." Later the axillary lymph nodes became enlarged and generalized lymphadenopathy followed. Radiation therapy was given in November 1939 and in January, May, and September 1940. Death occurred Jan. 20, 1943, and the postmortem examination revealed Hodgkin's disease.

CASE 2: J. M., male, aged 38, was first seen by us on Jan. 3, 1941, for a large lymph node on the right side of his neck of two years' duration. It was of semifirm consistency and measured 10 × 12 cm. in its largest diameters. Biopsies had been done elsewhere on two occasions, following which the patient was informed that he had a benign swelling of the lymph nodes. A biopsy taken in January 1941 showed typical giant follicular lymphadenopathy. Following an intensive course of radiation therapy, with a total of 7,400 r, the lesion disappeared completely. The patient has been under observation since that time, and for almost six years has shown no evidence of disease.

CASE 3: P. A., male, aged 41, was first seen in our department on Feb. 26, 1941, showing swelling of the lymph nodes in both axillae and in the left abdomen. A widening of the mediastinal shadow was demonstrable on x-ray examination. Symptoms had first occurred in 1928, and at that time, on the basis of the microscopic findings, were considered to be of benign nature. On other occasions, the diagnosis of lymphosarcoma had been made. Later, enlarged lymph nodes appeared in the right supraclavicular fossa, and x-ray therapy was given in different institutions with the result that the skin showed atrophy and telangiectases, indicating that a large amount of radiation had been given to the involved areas. The patient has remained free of symptoms for the past five and a half years.

CASE 4: E. Z., male, aged 47, was first seen in our department on April 8, 1941, presenting himself with a generalized lymphadenopathy. His first symptoms occurred in 1936, when a biopsy from a lymph node was interpreted as lymphoid hyperplasia. Shortly before the patient was referred to us, a biopsy from an abdominal lymph node, taken during a laparotomy for intestinal obstruction, had been interpreted by the pathologist as a small-cell variety of lymphosarcoma. Radiation therapy was given on five occasions during the year 1941, and death occurred in January 1942. A postmortem examination was performed and a diagnosis of lymphatic leukemia was established. During the patient's lifetime, while he was under observation in our department, the white count had been between 3,200 and 7,000 white cells, without showing changes in the differential count indicative of a leukemic picture.

CASE 5: C. R., female, aged 28, was first seen by us on May 22, 1941, for swelling of a lymph node in the left side of the neck. The patient had first noticed it in 1936, and had received x-ray therapy, following which the swelling disappeared. Later, lymph node enlargement developed on both sides of the neck and in both axillae, and a widening of the mediastinum was seen upon x-ray examination. A biopsy showed giant follicular lymphadenopathy. X-ray therapy was given in May 1941 to the cervical lymph nodes, and in July 1942 to the axillary lymph nodes, as well as to the mediastinum, and the patient has remained free of symptoms for almost four and a half years.

CASE 6: E. F., male, aged 25, was first seen in our department on May 28, 1941, for enlarged lymph nodes in the abdomen. He had had symptoms for approximately five months. Later, enlargement of the spleen and the liver developed. A biopsy taken from one of the lymph nodes showed giant follicular lymphadenopathy. Following x-ray therapy in May and November of 1941, the patient has been well for five years.

CASE 7: C. K., female, aged 58, was first seen by us on June 12, 1941, with lymph node enlargement on the right side of the neck, of a year's duration. Biopsy revealed changes that were interpreted as benign hyperplasia and Hodgkin's disease. Later lymph nodes on both side of the neck were enlarged. X-ray therapy was given in June and July 1941 and the patient has been free of symptoms for five and a half years.

CASE 8: M. F., female, aged 31, was first seen in our department on June 16, 1941, with palpable lymph nodes in the left axilla. These had been present for fifteen months, and there was a spread to the left groin, as well as to both sides of the neck. Biopsy of a lymph node from the axilla showed giant follicular lymphadenopathy. The patient received radiation therapy in July 1941, and has remained free of symptoms for over five years.

CASE 9: E. O., female, aged 22, was seen in the department on June 17, 1941, for follow-up examination. She originally had been seen in May 1937, four years previously, with enlarged lymph nodes on the right side of the neck. Both sides of the neck had subsequently become involved. Following radiation therapy in June, September, and December 1937, and in January 1938, all lymph nodes disappeared and the patient has remained well since that time. The original diagnosis was atypical Hodgkin's disease, but review of the microscopic description of a biopsy taken in 1937 confirmed the diagnosis of giant follicular lymphadenopathy. The patient has been well now for over nine years.

CASE 10: A. H., male, aged 50, was first seen by us on July 21, 1941, with a generalized lymphadenopathy. The symptoms had been present for approximately six months, and a biopsy of an inguinal node had led to a diagnosis of chronic lymphadenitis. A review of the slides showed typical giant follicular lymphadenopathy. The patient had enlargement of the spleen, and received radiation therapy in July 1941, in April, September, and December of 1942, in March, July, and October of 1943, and in June and September of 1944. A low white blood count

prevailed during the entire course of the disease; there were no changes in the differential count, but the patient showed an elevated basal metabolism before each recurrent generalized lymphadenopathy. He died on Dec. 17, 1944, and postmortem examination revealed an aleukemic lymphatic leukemia with particular involvement of the retroperitoneal lymph nodes, spleen, and liver.

CASE 11: B. H., male, aged 61, was first seen in our department on Jan. 9, 1942, with swelling of lymph nodes in the neck. He had noticed this swelling for approximately three months. A biopsy was interpreted as showing a reticulum-cell type of lymphosarcoma; but there was no definite agreement among the pathologists about this diagnosis. The patient had a marked leukopenia during the short time he was under our observation. He died on Jan. 24, 1942, only two weeks after admission, and a postmortem examination was performed. The pathologic diagnosis was leukosarcomatosis with involvement of the abdominal lymph nodes, kidneys, spleen, the entire gastro-intestinal tract, and bone marrow, with leukemic ulcerations of Peyer's patches.

CASE 12: E. S., female, aged 56, was first seen by us on June 26, 1942, for enlarged lymph nodes. She had noticed a swelling of the abdomen for approximately three months, and later lymph nodes became palpable in both sides of the neck, and in both supraclavicular fossae; the spleen and liver were also enlarged. A biopsy showed giant follicular lymphadenopathy. After radiation therapy in June 1942, the patient was well for eighteen months. She again received radiation treatment in January and June 1944, in April and October 1945, and in July 1946. She is alive but still under medical care for recurrent lymphadenopathy.

CASE 13: S. M., female, aged 67, was first seen in our department on Jan. 14, 1943, with a large swelling of a solitary lymph node on the right side of the neck. An aspiration biopsy showed giant follicular lymphadenopathy. This swelling had been present for approximately three months; there were no other symptoms. Radiation therapy was given in January 1943, for a total of 2,200 r, and the patient has been well ever since.

CASE 14: K. A., female, aged 53, was first seen by us on June 22, 1940, with an enlarged spleen and lymph nodes on the left side of the neck. A biopsy showed typical giant follicular lymphadenopathy. The symptoms had been present for approximately four months. Later, lymph nodes were palpable on both sides of the neck and in both axillae. Radiation therapy was given in June and October 1943. The patient died on Nov. 17, 1944, with symptoms of intestinal obstruction. No postmortem examination was performed.

CASE 15: J. K., male, aged 37, was first seen in our department on June 24, 1944, with a swelling of the lymph nodes in the right groin. A biopsy showed giant follicular lymphadenopathy. This swelling had been present for about three months. Later, lymph nodes were palpable in the left axilla and on both sides of the neck. Radiation therapy was given. Since July 1944, the patient has shown no symptoms of the disease.

CASE 16: R. G., male, aged 16, was first seen by us on Feb. 1, 1944, for a swelling of lymph nodes on both sides of the neck. This had been present for over a year and had increased to such an extent that the patient was considerably deformed. Aspiration biopsy revealed giant follicular lymphadenopathy. Later, lymphadenopathy became generalized, with involvement of the abdominal lymph nodes, enlargement of the liver and spleen, and parenchymal infiltration of the lungs. Radiation therapy was given in February, June, August, and October of 1944, and death occurred on Nov. 12, 1944. Postmortem examination was performed and the pathological diagnosis was lymphatic leukemia. During the last months of his life, the patient had an increased white blood count with a high percentage of lymphocytes.

CASE 17: F. G., female, aged 37, was first seen in our department on Jan. 11, 1945. She had noticed swelling of the axillary lymph nodes for the past two months, and a biopsy showed typical giant follicular lymphadenopathy. Enlarged lymph nodes also appeared on both sides of the neck. Radiation therapy was given in January 1945, and the patient was well until January 1946, when the lymph nodes in both axillae again became enlarged, as well as those in the left epitrochlear region and in the left groin. Radiation therapy was again given and the patient has been well since that time.

CASE 18: M. E., female, aged 27, was first seen by us on June 21, 1945, for generalized lymphadenopathy which had been present for approximately three months. A biopsy of a lymph node in the axilla showed giant follicular lymphadenopathy, and the patient received radiation therapy in June 1945. Since that time she has remained well.

CASE 19: E. N., female, aged 30, was first seen in our department on Dec. 8, 1945, with generalized lymphadenopathy. She had had these symptoms for eight months and had received small amounts of radiation (outside of our department). The lesions had disappeared but recurred after an interval of only two months. A biopsy showed typical giant follicular lymphadenopathy, and the patient received radiation therapy in December 1945 and in January 1946. She has remained well since that time.

CASE 20: J. R., male, aged 49, was first seen by us on Dec. 31, 1945. He stated that he had had enlarged lymph nodes on the right side of his neck throughout his entire life; during the last two years he had noticed an increase in their size, as well as an involvement of other regions of the body. His blood had been examined on numerous occasions and always found to be normal. A lymph node was excised and a typical giant follicular lymphadenopathy was found. Radiation therapy was given to

TABLE I: SUMMARY OF AUTHOR'S CASES

Case No.	Sex and Age	Symptoms Present	First Localization	Course	Final Diagnosis
1	M 40	6 mo.	Neck	Death after 3 yr.	Hodgkin's disease
2	M 38	2 yr.	Neck	Well 6 yr.	Giant follicular lymphadenopathy
3	M 41	13 yr.	General	Well 5½ yr.	Giant follicular lymphadenopathy
4	M 47	5 yr.	General	Death after 1 yr.	Leukemia
5	F 28	5 yr.	Neck	Well 4½ yr.	Giant follicular lymphadenopathy
6	M 25	5 mo.	Abdomen	Well 5 yr.	Giant follicular lymphadenopathy
7	F 58	1 yr.	Neck	Well 5 yr.	Giant follicular lymphadenopathy
8	F 31	15 mo.	Axilla	Well 5 yr.	Giant follicular lymphadenopathy
9	F 22	4 yr.	Neck	Well 9 yr.	Giant follicular lymphadenopathy
10	M 50	6 mo.	General	Death after 4 yr.	Aleukemic leukemia
11	M 61	3 mo.	Neck	Death after 2 weeks	Leukosarcomatosis
12	F 56	3 mo.	Abdomen	Under treatment	Giant follicular lymphadenopathy
13	F 67	3 mo.	Neck	Well 4 yr.	Giant follicular lymphadenopathy
14	F 53	4 mo.	Neck and spleen	Death after 16 mo.	Giant follicular lymphadenopathy*
15	M 37	3 mo.	Groin	Well 3 yr.	Giant follicular lymphadenopathy
16	M 16	13 mo.	Neck	Death after 9 mo.	Lymphatic leukemia
17	F 37	2 mo.	Axilla	Well after 18 mo.	Giant follicular lymphadenopathy
18	F 27	3 mo.	General	Well after 17 mo.	Giant follicular lymphadenopathy
19	F 30	8 mo.	General	Well 11 mo.	Giant follicular lymphadenopathy
20	M 49	2 yr.	General	Under treatment	Giant follicular lymphadenopathy
21	M 30	3 yr.	Supraclavicular fossa	Well 7 mo.	Hodgkin's disease
22	M 18	1 yr.	Neck	Well 3 mo.	Sarcoma

* No postmortem examination.

the superficial lymph nodes in January 1946, and they regressed, apparently completely. However, the patient was admitted to another hospital several months later with large lymph nodes in the retroperitoneal space and pressure on the kidneys. To our knowledge, he is still alive, but not well.

CASE 21: F. M., male, aged 30, was first seen in our department on April 20, 1946. For three years he had noticed a swelling of a lymph node in the right supraclavicular fossa. A lymph node in the left supraclavicular fossa also became enlarged. Biopsy specimens showed Hodgkin's disease in the lesion on the left side and giant follicular lymphadenopathy, plus Hodgkin's disease, in the lymph nodes excised from the right side. Following radiation therapy in April 1946, the patient has remained well.

CASE 22: F. P., male, aged 18, was first seen by us on Sept. 18, 1946, for swelling of the lymph nodes on the left side of the neck. He had had symptoms for approximately one year, and a lymph node had been removed and a diagnosis of benign lymphadenitis made. A second lymph node was removed in September 1946, showing remnants of giant follicular lymphadenopathy, but also polymorphous-cell sarcoma. The patient received radiation therapy in September 1946 and has been well since that time.

In these 22 patients, all the symptoms described in the literature as being pathognomonic for giant follicular lymphadenopathy were present at one time or another, but frequently the clinical picture was puzzling and misleading to such an extent that a correct diagnosis at the time the patient was referred was the exception rather than the rule.

We were able to establish a definite diagnosis of giant follicular lymphadenopathy through biopsy in 12 of these 22 patients when they were first seen. It is clear, however, from the clinical course of the disease, the microscopic findings, and, in several instances, from postmortem examinations, that all patients reported here fall into the category of giant follicular lymphadenopathy, with a single possible exception (Case 11). In this case, an atypical lymphosarcoma was first diagnosed. The clinical picture was that of an aleukemic leukemia, and the postmortem examination revealed a leukosarcomatosis, as described by Sternberg, consisting of a combination of leukemia with true tumor formation, as in lymphosarcoma.

In 2 patients in our group typical Hodgkin's disease eventually developed. One of these patients (Case 21) showed a coexistent giant follicular lymphadenopathy and Hodgkin's disease in the same lymph node. In another case (Case 1), the original diagnosis was benign hyperplasia or lymphadenitis, and the final diagnosis was Hodgkin's disease. Still another case

(Case 9) was originally diagnosed as atypical Hodgkin's disease, but from the description of the microscopic features, the conclusion can be drawn that the patient actually had giant follicular lymphadenopathy. The course of the disease, with freedom from symptoms for over nine years, seems to confirm this diagnosis.

Three patients who had generalized lymphadenopathy which was considered to be of benign nature on microscopic examination died with symptoms of leukemia. In all 3 instances the latter diagnosis was confirmed by postmortem examination.

One patient (Case 2) had lymphadenopathy which was diagnosed originally as of a benign nature. Other symptoms subsequently developed and, on later examinations, the diagnosis of sarcoma was established.

Of the 22 patients in this group, 12 were males and 10 females. Their ages varied from 16 to 67 years, the average being 39 years. In some instances the symptoms of which the patients complained had been in existence for only a short time; the majority had noticed symptoms for several months, and in others they had been in evidence for many years. Eleven patients had had their symptoms for less than one year, and 11 for more than one year.

In our group early involvement shows a definite predilection for the lymph nodes of the neck, 10 patients having had the first sign in this area. Some of these patients never showed any symptoms in any other location. Six patients did not notice any particular localization when they observed changes and were found to have generalized lymphadenopathy when first seen by us. In 2 patients the initial lymphadenopathy was in the abdomen, in 1 in the supraclavicular fossa, in 2 in the axillary lymph nodes, and in 1 in the groin.

There were only 2 patients who never showed any symptoms beyond the original localization. Both had lymphadenopathy in the neck area; both were treated with large amounts of radiation and remained well for almost six years (Case 2), and four years (Case 13), respectively. In the remaining 20 patients symptoms developed in other areas beyond the original ones, or symptoms were widespread from the onset of the disease.

In the case of 15 patients with giant follicular lymphadenopathy, the diagnosis was never changed, although it must be pointed out that in 9 of these the observation period is less than three years, and final judgment has to be withheld. Three patients eventually had leukemia, and all of them succumbed to the disease. In 1 patient a polymorphous-cell sarcoma developed, and 1 died from leukosarcomatosis. In 2 patients Hodgkin's disease occurred, and 1 died of intestinal obstruction, possibly in connection with his original disease.

Of the 6 patients who died, 3 had leukemia, 1 had Hodgkin's disease, and 1 had leukosarcomatosis.

Of the 9 patients who remained alive from three to nine years after first being seen in our department, 8 received large amounts of radiation therapy. We believe that the radiation therapy is responsible for their well-being. One patient had to interrupt her treatment frequently due to general malaise and low blood counts. Blood transfusions were necessary, as well as hospitalization on several occasions.

In other cases, which have been under observation for a shorter period, small amounts of radiation had been given originally which were sufficient to decrease the size of the lymph nodes and even to cause their disappearance. The lymphadenopathy recurred, however, or spread to other localizations. This is in line with Symmers' and Rubenfeld's observations, that only small amounts of radiation are necessary to make the lymph nodes in giant follicular lymphadenopathy disappear. It is our opinion, also, that these small amounts of radiation will influence the enlarged lymph nodes sufficiently to bring about their disappearance, but it is our impression that these small doses

are not sufficient actually to control the disease. Patients so treated may return with local recurrence or with generalized lymphadenopathy at a subsequent date. One of our patients (Case 19) offers a good example of this, showing recurrence and spread of the disease only two months after the initial therapy, but, after being treated with large amounts of radiation, remaining well for eleven months (to date), despite the fact that the disease was much more widespread at the last treatment than originally. There is, of course, no guarantee that this patient will continue well.

In conclusion, we can make the following statements: giant follicular lymphadenopathy may, in the initial stage, produce very little discomfort and so few symptoms that they may be considered insignificant by patients as well as physicians. The correct diagnosis can be made if the pathologist is familiar with the microscopic findings. It is an established fact that the disease, seemingly of benign nature, can develop into a true malignant condition, such as leukemia, sarcoma, or Hodgkin's disease. The most interesting fact to us is that any one of these three diseases may follow the original giant follicular lymphadenopathy, and this may be taken as another sign of the close relationship between these different forms of so-called lymphoblastoma. Furthermore, while we agree that small amounts of radiation will be sufficient in most instances to produce the disappearance of the involved lymph nodes, we do not believe, on the basis of our observations, that this represents a cure of the disease. There are indications, however, that if giant follicular lymphadenopathy is treated with large amounts of radiation, such as are commonly used in the treatment of malignant lesions, the patients will remain free of symptoms for many years. Since 6 of the 22 patients under our observation have remained symptom-free for a period of five years and longer, and others who have been followed for a shorter period of time may stay well for a similar time, we feel justified in not recommending a type of therapy which will control the original signs but in most instances not the disease itself. Judging from our experience, it seems to be logical to treat giant follicular lymphadenopathy from the very beginning as a potentially malignant disease, regardless of the fact that the microscopic findings may not warrant that diagnosis. In our opinion, the clinician should prevail over the pathologist and insist on intensive therapy which may control the symptoms and prevent the development of Hodgkin's disease, leukemia, and sarcoma.

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DISCUSSION

Steven O. Schwartz, M.D. (Chicago, Ill.): Dr. Uhlmann is to be congratulated for bringing before us this new therapeutic philosophy in regard to giant follicular hyperplasia. Up to the present time, both radiologists and hematologists have treated this condition with relatively minimal amounts of radiation, and this has been acceptable because the disease, or rather the individual lymph nodes, respond so readily in the beginning. Some of you may recall a recent series of editorials and comments, some of which appeared in the *Journal of the American Medical Association*, in which Meyer of Wisconsin takes issue with this philosophy of low dosage. In spite of this current practice, it is generally agreed that the condition has a recurrent character and ultimately results in one of the three or four types of malignant disease which Dr. Uhlmann has already mentioned.

Inasmuch as we know that the disease has this tendency to recur, and that these recurrences will follow in spite of small doses of radiation, it seems only logical to approach the problem somewhat differently than we have in the past, which is what Dr. Uhlmann has outlined for us.

Our experience with some of the cases which we have seen in collaboration has convinced us that larger doses of radiation are much more efficacious, both from the short-term standpoint and, as far as we are now able to tell, from a long-range point of view. It must be remembered, of course, that since about 50 per cent of these patients will survive five years, and about 15 per cent ten years, even with small doses of radiation, a long time must elapse before we can assess the ultimate value of the large-dose type of therapy.

Dr. Uhlmann's paper emphasizes the absolute necessity for the biopsy of nodes before therapy is undertaken. I think we are all at fault—radiologists and clinicians alike—in treating persistent lymph node enlargements with radium or x-rays without insisting on biopsy. And since biopsy is an entirely innocuous procedure, there is no justification for our negligence. Sometimes, unfortunately, too much consideration is given to the ease of obtaining the biopsy and to cosmetic results. Our idea has always been to obtain at least one node from the area of greatest involvement, even if cosmetically this is not so advantageous, because very often the nodes which are only slightly involved will show nonspecific changes which help us very little diagnostically.

Even biopsy has its limitations. Dr. Uhlmann pointed out in his paper (and it is well known from Symmers' papers) that the same node may show different types of pathological change, and this is even more true for different nodes. For this reason we cannot rely absolutely on biopsy.

The etiology of giant follicular lymphadenopathy is a most interesting subject. Our leaning has been that we are dealing in this group with infectious diseases very much akin to each other, and following the benign to malignant sequence already outlined.

Finally, we might mention in passing that, in addition to radiation therapy, we are now working with a new therapeutic agent, the so-called nitrogen-mustards, which may give us some additional aid in the treatment of this group of diseases.

Harold W. Jacox, M.D. (New York): I think much depends on the pathologist in this disease. Even pathologists do not agree on lymph node biopsies. I have seen pathologists—very good men—look at the same slide, one giving one interpretation, and another another.

I would like to ask Dr. Uhlmann what he means by "larger doses" and "smaller doses."

Edgar P. McNamee, M.D. (Cleveland, Ohio): I would like to ask a question. If a single node, say in the neck, is involved and is completely removed, is there any necessity for postoperative irradiation? I would also like to know how surgical removal is regarded.

Dr. Uhlmann (*closing*): I am grateful to the discussants for their remarks. One of the reasons for presenting this paper was to point out the difficulties sometimes encountered in establishing a definite diagnosis. It has been our experience that many pathologists are unfamiliar with the disease entity of giant follicular lymphadenopathy and report their microscopic findings as benign hyperplasia. For this reason, we have made it a habit to review all the microscopic slides of lymph nodes which were reported as benign hyperplasia or lymphadenitis. As has been stated, we were able to establish a correct diagnosis in many instances.

As to the question, what constitutes a small dose or a large dose of radiation: in our experience, it is frequently possible to decrease the size of the involved lymph nodes or even make them disappear completely with 300 to 400 r. Patients so treated may be well for several months and then may have a recurrence of the swelling of the lymph nodes. For that reason, we give a minimum of 2,000 r to small or medium sized lymph nodes and have given as much as 3,000, 5,000, or even 7,000 r in selected cases. As stated before, we believe that the large amount of radiation is important for the control of the disease.

The question of postoperative irradiation is somewhat more difficult to answer. If a single lymph node is involved and this can be completely removed, there would theoretically be no need for postoperative irradiation. In the patients under our observation, solitary lymph nodes were of such size that they could not be completely removed by surgery and these patients have received the benefit of radiation. I am in agreement with Dr. Schwartz that it is in general not possible to remove all involved lymph nodes by surgery and it is preferable to treat them with radiation.

SUMARIO

La Importancia de la Linfadenopatía Folicular Gigante (Enfermedad de Brill-Symmers)

La linfadenopatía folicular gigante (enfermedad de Brill-Symmers) caracterízase por hiperplasia localizada o generalizada de los ganglios linfáticos superficiales, asociada a menudo con esplenomegalia. Casi nunca hay dolor y la sangre periférica no muestra alteraciones características. El estado es confundido frecuentemente

con la enfermedad de Hodgkin, pero los hallazgos microscópicos son bastante típicos. En la mayor parte de los casos se altera, pero sin quedar completamente destruída, la estructura anatómica de los folículos linfáticos. Histológicamente, éstos muestran hiperplasia numérica y dimensional. Aunque aparentemente benigna, la dolencia puede convertirse en un verdadero estado maligno, tal como leucemia, sarcoma, o enfermedad de Hodgkin, indicando así la íntima relación entre esas diversas formas del llamado linfoblastoma.

El A. comunica 22 casos en enfermos de 16 a 67 años de edad, habiendo síntomas presentes desde 2 meses a 13 años. En 2 casos la enfermedad permaneció localizada en su asiento primitivo; en el resto ya había propagación a otras zonas o invasión general al hacerse la primera observación. En 3 enfermos se produjo leucemia, en 1 sarcoma polimorfocelular, leucosarcomatosis en 1 y enfermedad de Hodgkin en 2. Seis enfermos han muerto, 9 sobrevivieron de 3 a 9 años desde que los observara el A. por primera vez, y los demás han estado en observación menos de 3 años. De los 9 que sobrevivieron más de 3 años, 8 recibieron radioterapia a dosis masivas. Aunque pequeñas dosis de radiación (300 a 400 r) harán desaparecer temporalmente el infarto ganglionar, no cree el A. que basten para cohibir la enfermedad. El administra como mínimo 2,000 r a los ganglios más pequeños, con dosis mayores (hasta 7,000 r) en casos seleccionados.

The Diaphragm

A Roentgen Study in Three Dimensions[1]

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THAT THE DIAPHRAGM is commanding more and more attention on the part of physicians and surgeons is evidenced by the greater frequency of requests for information regarding its condition. This is due to the following reasons.

1. The diaphragm is frequently the seat of congenital defects and anomalies because of faulty embryonal development which may result in herniation or displacement of abdominal organs into the thoracic cavity.

2. The diaphragm contains several openings for the passage of important structures between the thoracic and abdominal cavities. These openings, especially the esophageal, often become lax, resulting in herniation of a part or the whole of the stomach into the thoracic cavity. There is some evidence that the reverse of this, cardiospasm, is due to spasm of the esophageal opening.

3. The diaphragm is a thin musculotendinous membrane serving as the floor of the thoracic cavity and the roof of the abdominal cavity, as well as its upper posterior wall, but it does not accord with the usual conception of a rigid floor, roof, or wall, being relatively unstable and readily affected by pressure from above or below.

4. The diaphragm is in intimate relationship with the pleura, lungs, pericardium, and heart above, and with the liver, spleen, stomach, pancreas, kidneys, and often the colon below. It is evident that any enlargement of these structures may affect its position and mobility. General enlargement of the abdomen due to air, fluid, or large abdominal tumors will produce the same effect.

5. The diaphragm is the most important organ of respiration. Any deviation from the normal rate and degree of excursion may be readily observed fluoroscopically and the probable underlying cause determined.

6. The diaphragm is constantly under a physical strain in maintaining a proper balance between the positive abdominal pressure and the negative thoracic pressure. Any abnormal condition either above or below may readily upset this balance, resulting in change in position and impairment or cessation of mobility.

From the foregoing observations, it is evident that the diaphragm, both anatomically and physiologically, is a vulnerable structure, being readily involved by pathological changes arising from above and below and as a result of the inherent weakness of the structure itself.

Roentgen study has, indeed, advanced our knowledge of the diaphragm, but so far the greatest attention seems to have been paid to the anteroposterior projection. This would ordinarily be sufficient if the surface of the diaphragm were horizontal throughout, but such is not the case. The two leaves have the shape of domes; the highest points are located medially and anteriorly, and from these there is a downward slope in the lateral and backward extensions. Therefore, in an anteroposterior view only the surface of the highest level can be seen; the rest is out of sight. Moreover, between a third and one-half of the diaphragm lies behind the heart and is not seen at all. Thus, for a satisfactory roentgen examination of the entire diaphragm, a lateral as well as a frontal view is essential. This technic was carried out in a large number of chest examinations a good many years ago (1) with gratifying results and since that time we have been able

[1] Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1-6, 1946.

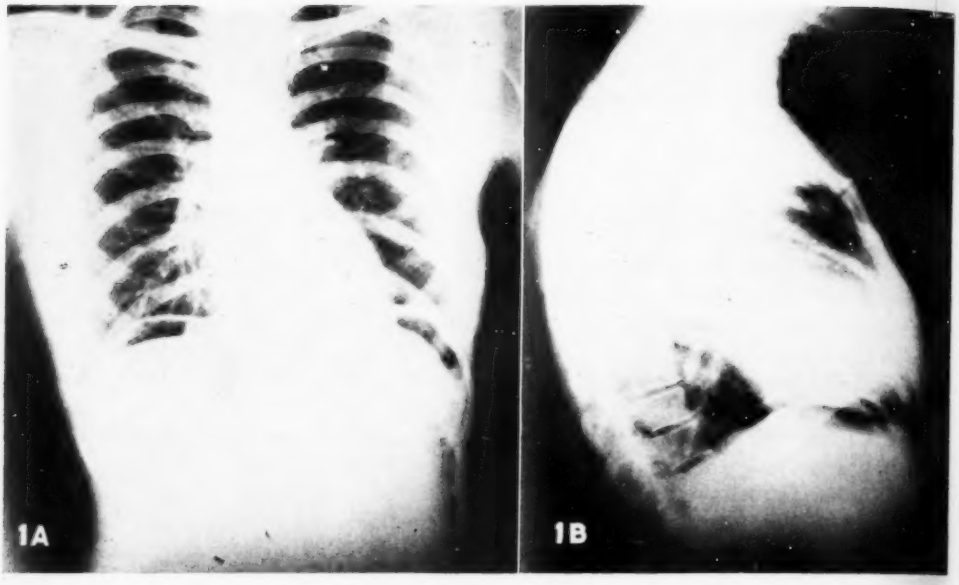

Fig. 1. The isolated diaphragm separated by air from the underlying structures. A. Anterior view. B. Lateral view.

to confirm our observations, showing many abnormal conditions which were hardly suspected in the customary frontal projection.

The diaphragm, being in intimate contact with the underlying structures, cannot be seen by itself, but the presence of free intra-abdominal air introduced artificially or accidentally enables one to see it isolated and gives a more accurate idea as to its position, shape, contour, and thickness.

Figure 1 is reproduced in order to demonstrate the isolated diaphragm. As a result of a perforation of a duodenal ulcer, free air entered the peritoneal cavity. In the erect position air collected under the diaphragm, separating it from the underlying structures. The diaphragm is seen to be rather thin and delicate, so that it is not surprising that it is so readily affected by neighboring organs.

Figure 2 shows the normal diaphragm in the average subject, in the anterior and lateral projections. In the anterior view (A) two sharply defined arcs are seen on each side of the heart shadow. The right one is on a somewhat higher level than the left. Between the two arcs the diaphragm is slightly depressed by the heart and pericardium, to which it is firmly adherent. Each arc has two angles, the costophrenic and cardiophrenic. Normally the latter is on a higher level than the former. In general, the position of the diaphragm varies with the habitus of the individual, being high in the stout and short, low in the tall and slender, and ranging between the two extremes in others. In the lateral position (Fig. 2, B) two arcs, more or less overlapping, are seen extending from before backward, representing the right and left leaves of the diaphragm. The anterior costophrenic angle is on a higher level than the posterior. The leaves are not on the same level, the left being higher posteriorly than the right. This is contrary to what is seen in the anterior projection, in which the right side is invariably on a higher level than the left. One may have some difficulty in determining which of the arcs represents the right or left side. However, if gas is present in the fundus of the stomach, the differentiation is easily made by noting the

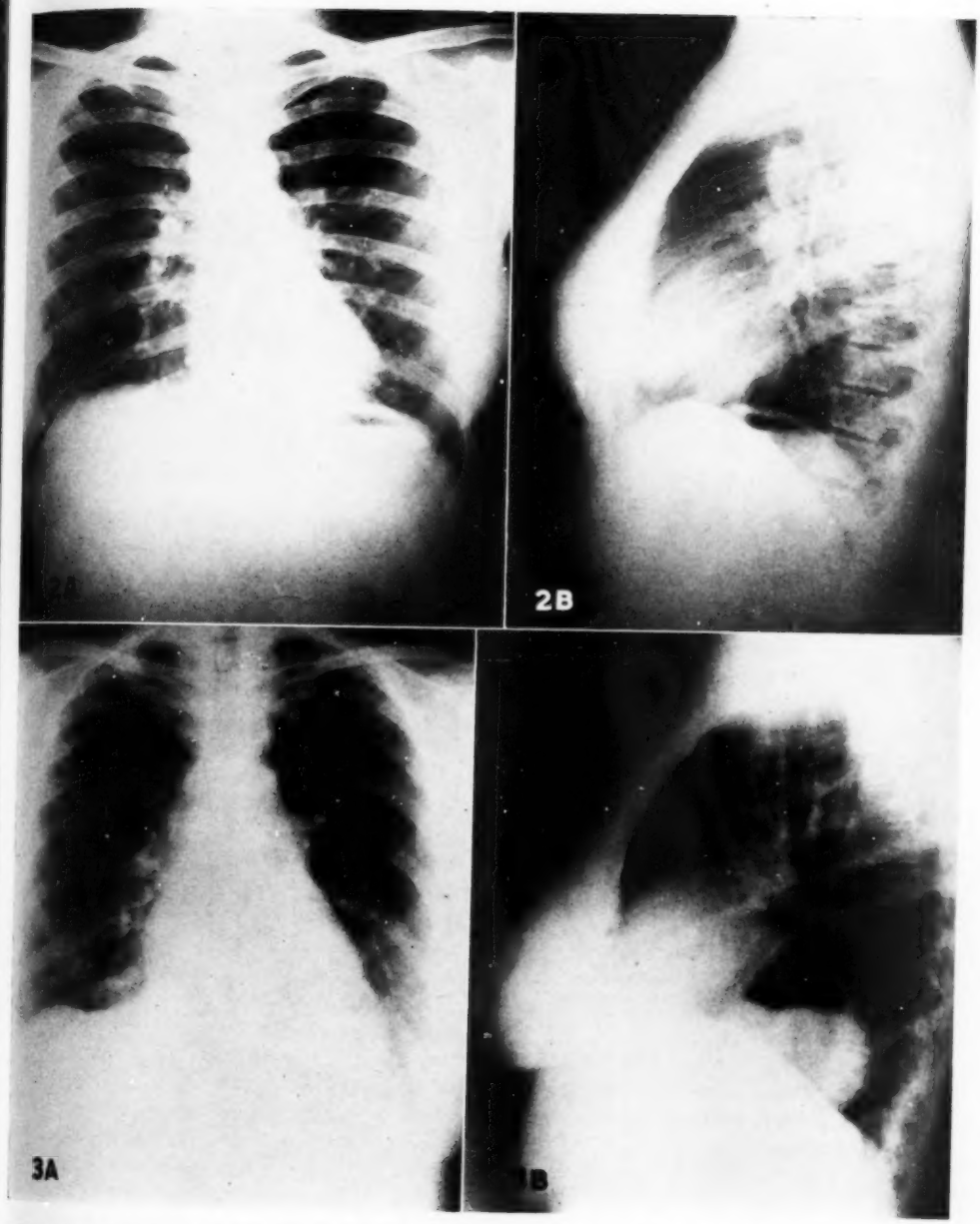

Fig. 2. A. Anterior view, showing diaphragm in intimate contact with the underlying structures. Note gas in the fundus. B. Lateral view, showing posterior costophrenic angle on a lower level than the anterior. Note gas in fundus beneath the left posterior diaphragm, which is on a higher level than the right.
Fig. 3. A. Anterior view, showing nothing unusual about the diaphragm. B. Lateral view, revealing a distinct pocket containing fluid with gas behind the heart, due to esophageal hiatus hernia.

gas pocket beneath the left leaf of the diaphragm.

Diaphragmatic hernias are, as a rule, readily recognized even without the ingestion of a barium meal or an enema, for they often contain gas, but when located behind

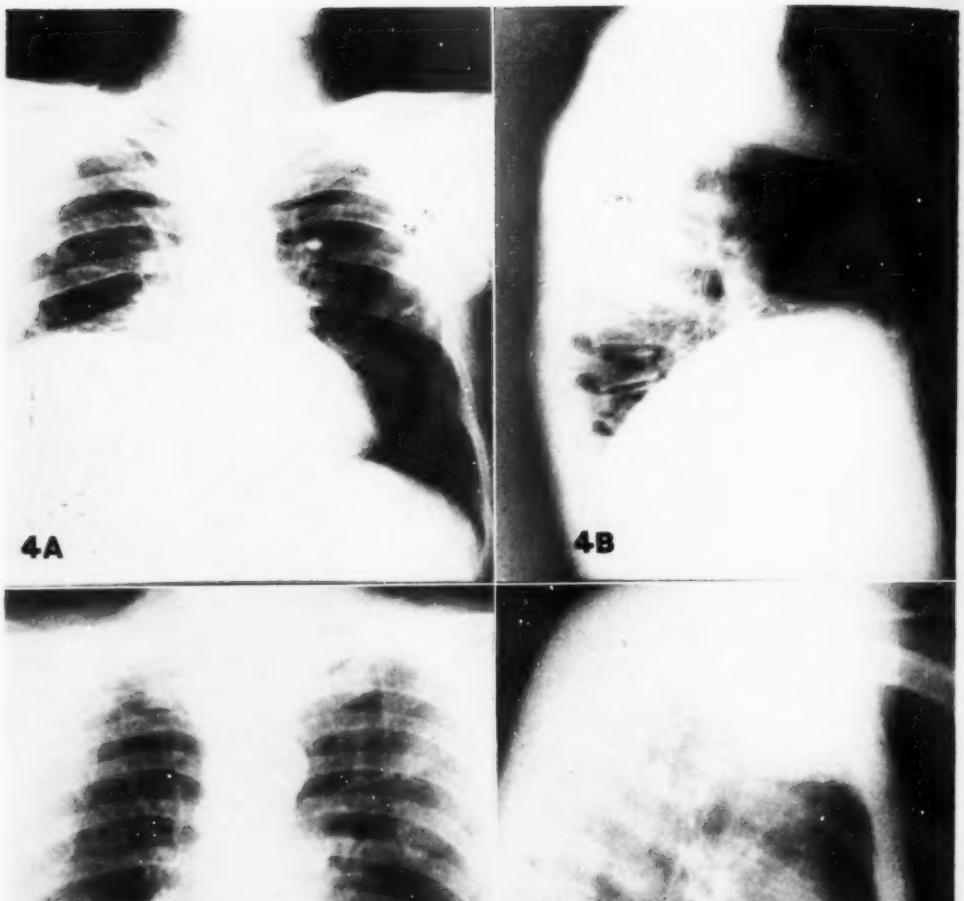

Fig. 4. A. Anterior view, showing right diaphragm elevated and right costophrenic angle diminished in size. B. Lateral view. The right diaphragmatic arc is increased. The posterior costophrenic angle is low and clear. This finding usually indicates an enlarged liver.

Fig. 5. A. Anterior view, showing elevation of right diaphragm and obliteration of the right costophrenic angle. B. Lateral view. The right diaphragmatic arc is flattened and right costophrenic angle obliterated, forming a plateau, the "plateau sign of subphrenic abscess."

the heart shadow they may escape discovery. Since the retrocardiac space is better seen in the lateral position, hernias are more readily detected in that view. The case illustrated in Figure 3 is that of a middle-aged woman who was referred for a chest examination because of an anemic condition of unexplained origin. In the anterior view (A) nothing remarkable was noted. In the lateral view (B) a distinct pocket containing fluid with gas above was observed behind the heart shadow. This was interpreted as an esophageal hiatus hernia and was confirmed by a barium meal. The frequent association of anemia with esophageal hernia has long been recognized and was very likely the underlying cause in this case.

Elevation of the diaphragm is the most frequent abnormality encountered. It may be due to general or local causes. When due to general causes, the elevation is bilateral, as in the presence of increased intra-abdominal pressure caused by large masses, including the later stage of pregnancy, gaseous distention of the gastro-intestinal tract, and free fluid or gas in the peritoneal cavity. When the elevation is unilateral, the underlying cause is usually enlargement of the upper abdominal organs, as the liver, spleen, kidneys, or stomach, or phrenic paralysis. However, the general relationship of the anterior and posterior costophrenic angles remains unaltered.

One of our patients, a man beyond middle age, presented marked progressive painless jaundice. In the anterior view of the chest (Fig. 4, A) the right diaphragm was seen to be elevated and its excursions more or less impaired. In the lateral view (Fig. 4, B), also, the right diaphragm was elevated and the arc was increased. The costophrenic angles were clear and their position in relation to each other remained normal. Such a finding generally indicates a large liver; in this case it was due to metastasis secondary to carcinoma of the pancreas.

Another patient, a man of advanced age, was admitted to the hospital with an acute abdominal ailment. A chest examination in the anterior position (Fig. 5, A) revealed elevation and immobility of the right diaphragm. In the lateral position (Fig. 5, B) the elevation of the right diaphragm was quite marked, with obliteration of the posterior costophrenic angle, and flattening of the arc, forming a plateau—the "plateau sign of subphrenic abscess." The diagnosis was confirmed by necropsy, which revealed the antecedent cause to be a carcinoma of the cecum, which had perforated. Recognition of this sign has aided us in arriving at a correct diagnosis in a number of cases with results far better than in the case described. We are also convinced that immobility and elevation of the diaphragm without the "plateau sign" seldom indicate a subphrenic abscess.

Frequently one encounters bulges or humps, arising most often from the upper surface of the right diaphragm. Their exact origin, whether from the diaphragm or underlying structures, is difficult to determine. A pneumoperitoneum would assist in making the differentiation, but one hesitates to resort to such a procedure. In one instance, however, air was seen in the peritoneal cavity due to a perforation of a duodenal ulcer, and this helped us to establish the true origin of the hump. The patient, a physician, was examined and a duodenal ulcer was demonstrated. The chest examination showed a small hump arising from the right diaphragm (Fig. 6, A). Several months later the patient was admitted to the hospital because of an acute abdominal condition. X-ray examination of the chest (Fig. 6, B) showed free air under the right diaphragm, outlining the previously observed hump, which arose from the liver. It is our opinion that probably all these humps, or at least the majority of them, arise from the liver and not from the diaphragm.

Masses are often encountered above the diaphragm, but whether they originate from the lungs or from structures below the diaphragm is often difficult to decide. We have found that the study of the chest in the anteroposterior and lateral positions

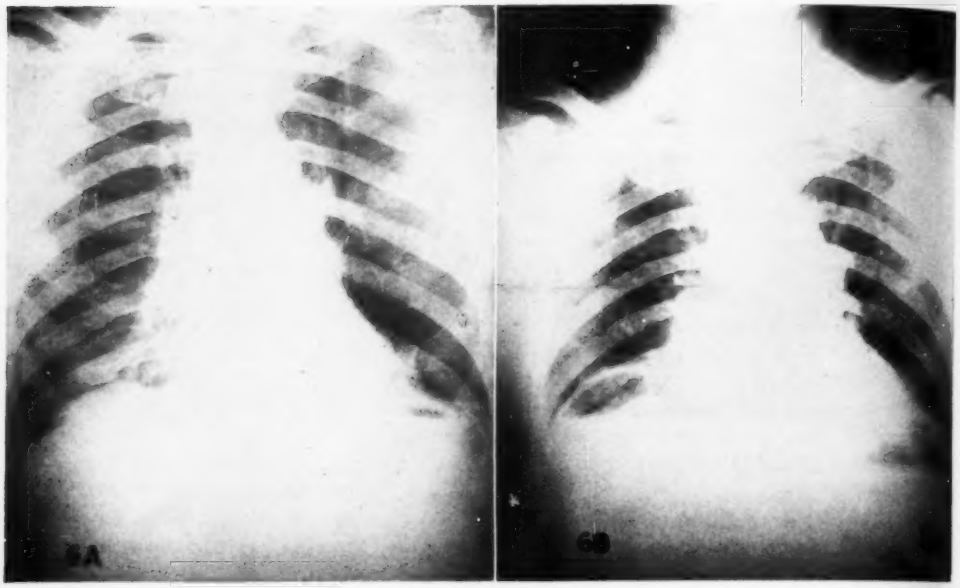

Fig. 6. A. Anterior view. The right diaphragm presents a hump, the exact origin of which is uncertain. B. Anterior view, made six months later, showing free air under right diaphragm and indicating that the hump originated in the liver.

will often help to determine their origin. In a routine examination of the chest in a young man, a homogeneous mass was discovered in the region of the right cardiophrenic angle (Fig. 7, A). In the lateral position the abnormal shadow was found to be located posteriorly, adjacent to the spine and below the right leaf of the diaphragm (Fig. 7, B). We were unable to determine its exact nature but we are certain as to its location and that it had its origin below the diaphragm, probably in the liver.

Another patient, a woman of 34, was operated upon for carcinoma of the uterus. Several months later, generalized metastasis developed. The anterior view of the chest (Fig. 8, A) showed elevation of the right diaphragm due to an enlarged liver, with a homogeneous mass in the region of the right cardiophrenic angle. In the lateral position the mass was shown to be located anteriorly above the diaphragm, evidently a pulmonary metastasis (Fig. 8, B).

Elevation of the left diaphragm is a frequent finding and is usually due to gaseous distention of the stomach or splenic flexure. When these two conditions can be excluded, however, by the absence of gas in either, elevation may be due to an enlarged spleen, kidney, pancreas, or retroperitoneal tumor. Figure 9 is an anteroposterior chest view showing moderate elevation of the left diaphragm with evidence of pulmonary metastatic nodules (Fig. 9, A). In the lateral position the diaphragm was elevated throughout, but the costophrenic angles were not obliterated (Fig. 9, B). X-ray examination of the stomach showed forward displacement in the left lateral decubitus position, indicating a retroperitoneal tumor, and backward displacement in the right lateral decubitus position due to an enlargement of the left lobe of the liver. These findings were confirmed by surgery and subsequently by necropsy. There was a primary tumor of the left lobe of the liver with retroperitoneal metastasis. The study of the diaphragm in the two positions gave the first clue to a possible intra-abdominal tumor.

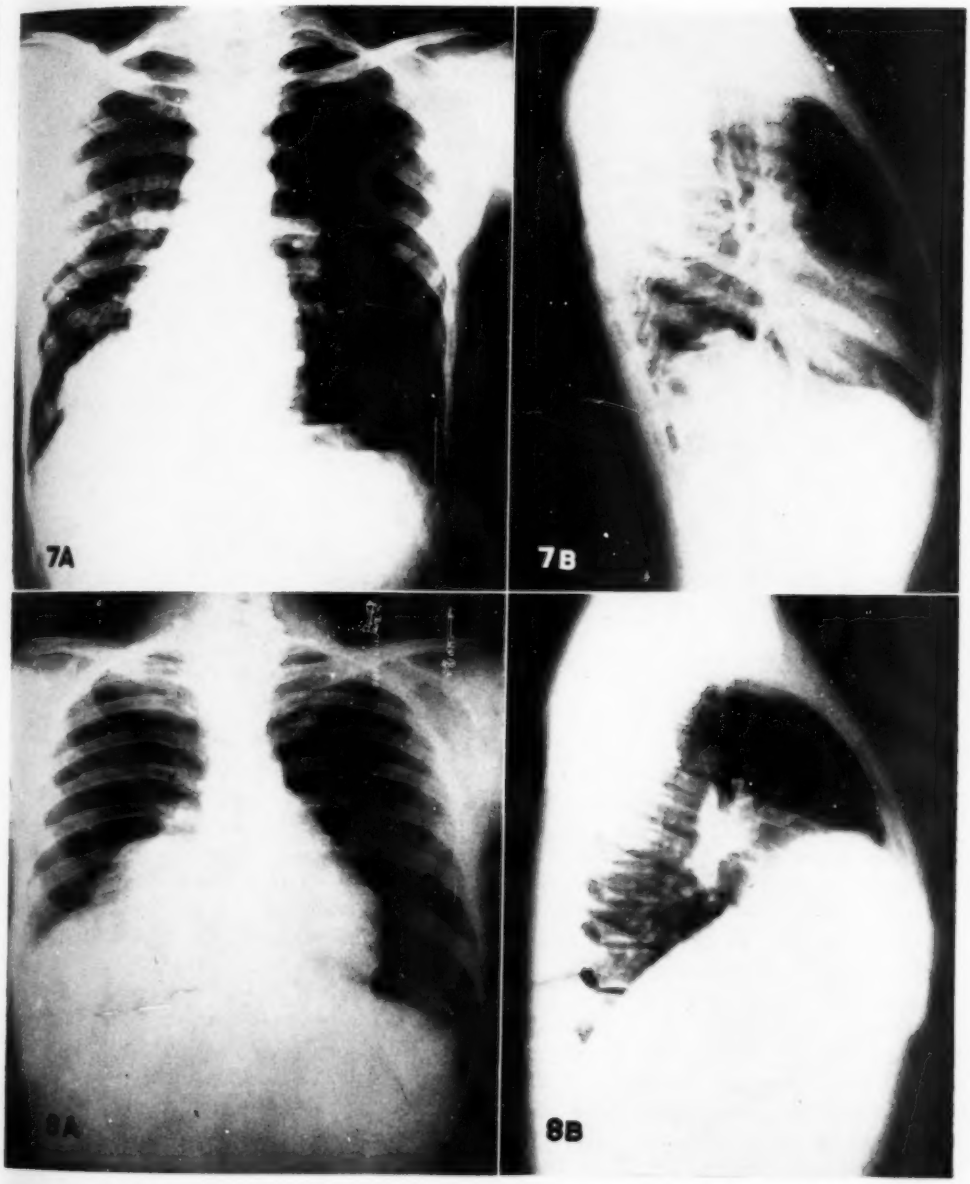

Fig. 7. A. Anterior view, showing a homogeneous mass in the region of the right cardiophrenic angle. B. Lateral view showing the mass to be located posteriorly beneath the diaphragm, adjacent to the spine.
Fig. 8. A. Anterior view, showing the right diaphragm elevated due to an enlarged liver, and a homogeneous dense mass located in the region of the right cardiophrenic angle. B. Lateral view. Homogeneous dense mass located anteriorly above the diaphragm adjacent to the heart.

The patient shown in Figure 10 presented evidence of a tumor in the right upper lobe of the lung (A). Only in the lateral position a rather large hump was noted posteriorly beneath the left leaf of the diaphragm (Fig. 10, B). We were unable to determine whether this hump indicated metastasis secondary to the pulmonary

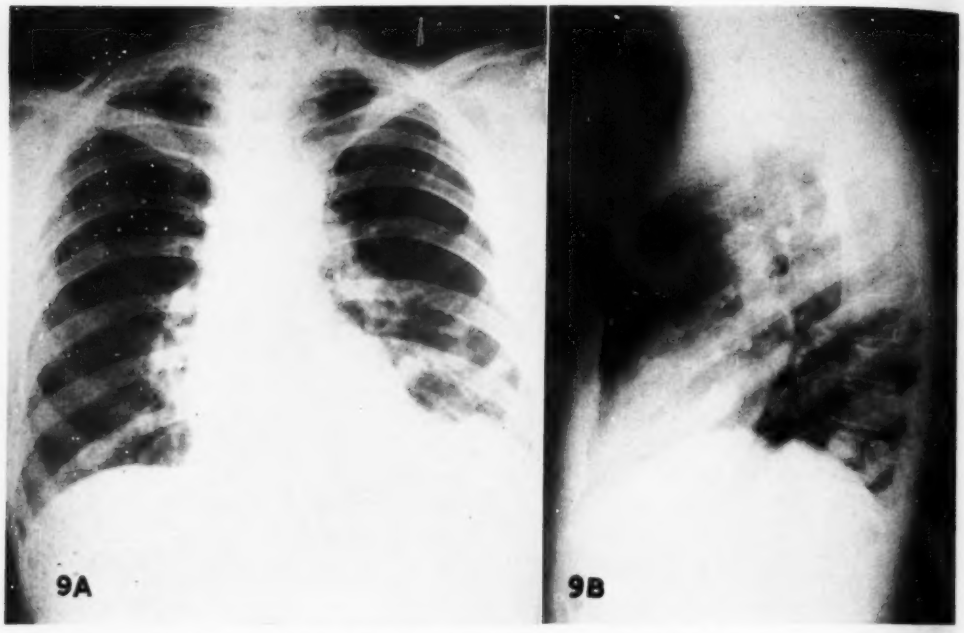

Fig. 9. A. Anterior view, showing left diaphragm elevated, with shadow of metastatic nodules in the left lung. B. Lateral view, showing elevation of the left diaphragm through its entire extent, proved to be due to a tumor of the left lobe of the liver.

tumor, but at least the lateral position enabled us to find it and determine that its location was under the left diaphragm.

Every study of the diaphragm should include a thorough inspection of the subphrenic region for possible free air, with or without fluid. The surgical implications are self-evident. In a patient with a history of gastric disturbances, a preliminary fluoroscopic inspection of the chest revealed a fluid level below the left diaphragm (Fig. 11, A). This is not unusual, but in this case the fluid and air extended to the right beyond the spine, which is not common in our experience. In order to determine the relationship between the stomach and the pocket of fluid and gas, a barium meal was administered, which revealed their independence in the lateral position. The stomach was located behind the pocket of fluid and gas (Fig. 11, B). The diagnosis of a subphrenic abscess located anteriorly to the stomach was made and confirmed by operation. It was proved to be due to a perforated gastric ulcer.

CONCLUSION

The fundamental roentgenographic principle of making two projections at right angles holds good in the study of the diaphragm.

Application of this technic has enabled us to demonstrate satisfactorily the complete topography of the diaphragm, showing the normal outline throughout its entire extent and revealing numerous deviations from the normal. It has made possible recognition (with or without the aid of a barium suspension) of herniation through any part of the diaphragm and determination of the exact location; differentiation between lesions originating above and below the diaphragm and uncovering of lesions not seen in the customary anterior projection; demonstration of elevation of the diaphragm, in whole or in part, often suggestive of intra-abdominal tumors; and finally—the most practical application of all—the diagnosis of subphrenic abscess. This is indicated by elevation of the diaphragm and obliteration of the pos-

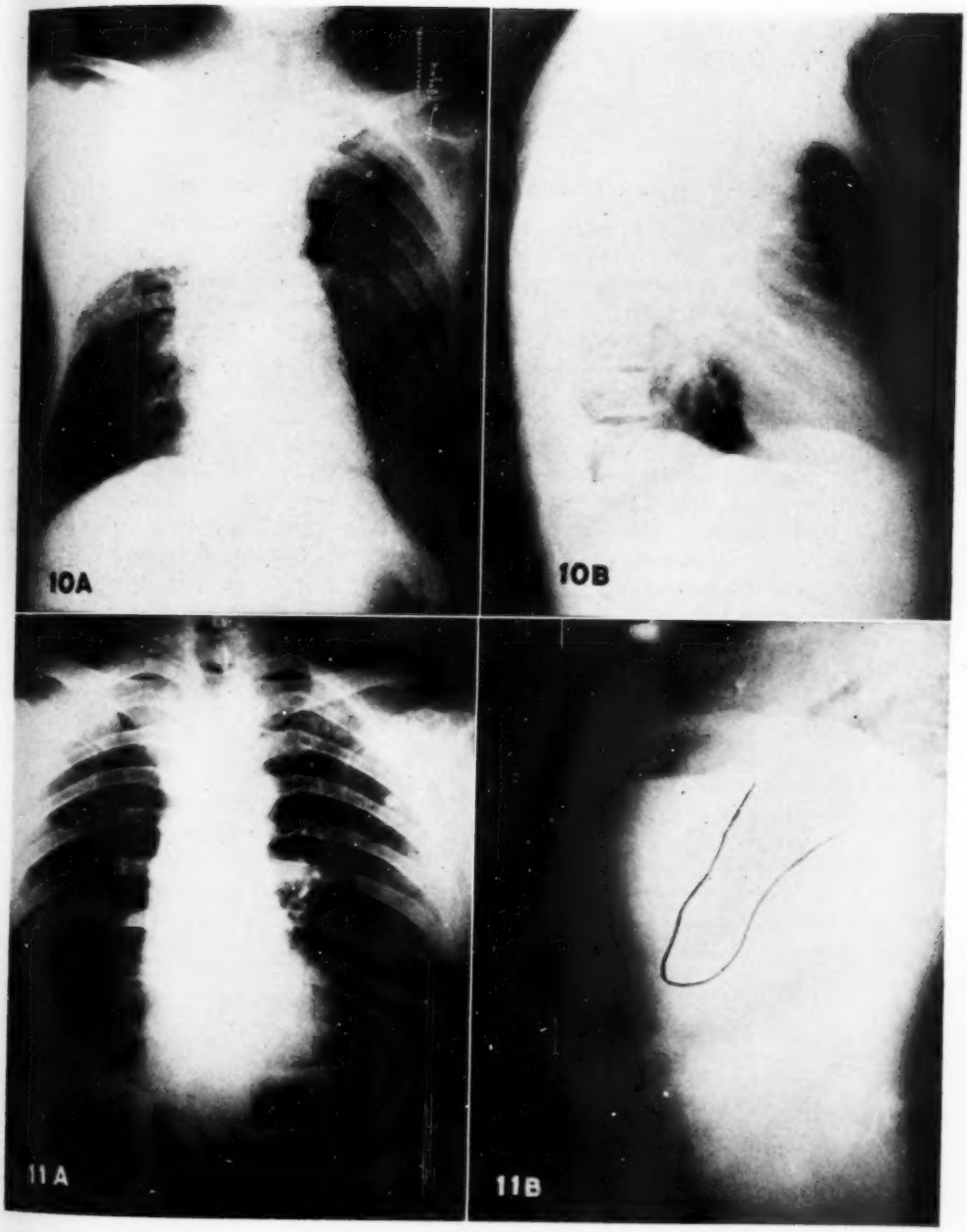

Fig. 10. A. Anterior view. Pulmonary tumor of right upper lobe, with a slight medial bulge of the left diaphragm. B. Lateral view, showing large hump located beneath the left diaphragm posteriorly, adjacent to the spine.

Fig. 11. A. Anterior view, showing fluid and air beneath the left diaphragm, extending across the spine, an unusual finding with gas in the stomach. B. Lateral view. The fluid and air are located in front of the stomach, beneath the diaphragm, proved to be due to an anterior subphrenic abscess.

terior costophrenic angle giving the appearance of a flattened plateau-like surface, the "plateau sign of subphrenic abscess."

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1. BROWN, S.: J. A. M. A. 97: 678–681, Sept. 5, 1931.

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SUMARIO

El Diafragma: Estudio Radiológico en Tres Dimensiones

En el estudio del diafragma retiene todo su vigo el fundamental principio radiográfico de obtener dos proyecciones en ángulos rectos. La aplicación de esta técnica ha capacitado a los AA. para mostrar la completa topografía del diafragma, revelando el contorno normal en toda al extensión del órgano, así como numerosas anomalías. Ha permitido el reconocimiento (con o sin la ayuda de una suspensión de bario) de hernias en las distintas partes del diafragma y la determinación de su situación exacta; la diferenciación entre las lesiones radicadas más arriba y más abajo del órgano y el descubrimiento de lesiones inobservadas en la habitual proyección anterior; la observación de elevación, total o parcial, del diafragma, que a menudo sugiere la existencia de tumores abdominales, y por fin—y ésta es la aplicación más práctica—el diagnóstico del absceso subfrénico. La presencia de éste queda indicada por la elevación del diafragma y la obliteración del ángulo costofrenico posterior, creando el aspecto de una superficie aplastada, o sea lo llamado "signo en meseta del absceso subfrénico."

Development of the Betatron for Electron Therapy[1]

L. S. SKAGGS, Ph.D.,[2] G. M. ALMY, Ph.D.,[3] D. W. KERST, Ph.D.,[3] and L. H. LANZL[3]

With an Introduction on

The Therapeutic Principles of Fast Electrons

by

ERICH M. UHLMANN, M.D [4]

Introduction

Electrons, also called cathode rays, or beta rays, have been suggested for therapeutic use at various times. Successful attempts were made in 1928 to liberate cathode rays from a modified x-ray tube, and these rays were used in the treatment of superficial skin lesions. The therapeutic effects were similar to those of x-rays, but the method did not become popular because the limited penetration power of electrons produced with 200,000 to 250,000 volts made them unsuitable for the treatment of most malignant lesions.

Lange and Brasch, by using an impulse generator, were able to produce electron beams with 1.7 and 2.4 million electron volts. Even with these considerably higher tensions, the penetration was limited to several millimeters of tissue. Trump, Van der Graaff, and Cloud produced electrons with a high-voltage generator and an acceleration tube of up to 3 million volts, and it was hoped that a further increase in voltage on the same basic principle might provide for the possibility of treatment with electrons to a greater depth. The development of the betatron by Kerst, however, opens an entirely new approach to this problem and makes it possible to consider actual use of fast electrons in the treatment of deep-seated cancer.

Although there is no difference to be expected in the effect of fast electrons on the tissue itself, there is a very marked difference in the range of the beam and its distribution within the tissue, as compared with x-rays or gamma rays of radium. The limitations in the use of radiant energy from traditional sources are not due to the fact that x-rays or gamma rays do not sufficiently destroy cancer cells, but rather that, in doing so, they also damage the normal tissue. This effect, which is always greater in the overlying tissue, spreads to the tissues underlying and surrounding the actual cancer and limits the amount of energy which can safely be applied to the malignant tumor.

In contrast to x-rays or to the gamma rays of radium, the concentration of energy in a beam of fast electrons is not at the source but at the end of the radiation. Furthermore, the beam itself is limited in its range by the amount of voltage used in its production. Therefore, electrons will reach only a certain predetermined depth and will not go beyond this calculated range. Since the concentration of energy is at the end of the beam, the overlying tissue will receive less intensive radiation than the actual tumor, in this way reversing the conditions under which radiation therapy is at present administered. For the first time, it seems possible to concentrate almost the entire radiant energy in the tumor itself, without simultaneously irradiating underlying or surrounding tissue, and with relatively small amounts of energy affecting the overlying tissue. For these reasons, it seems logical to use the betatron for the liberation of an electron beam with sufficient range to reach any malignant growth.

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[1] Read before the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–6, 1946. This work was supported in part by Contract N6ori-71 of the Office of Naval Research (University of Illinois) and in part by donations by Mr. and Mrs. Edgar Bibas (Michael Reese Hospital).

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The work that deals with the actual liberation of the electron beam from the 22-million-electron-volt betatron was done at the University of Illinois in close co-operation with Drs. Kerst, Almy, and Mr. Lanzl and will be presented by Dr. Lester Skaggs, who carried through these experiments.

THE BETATRON WAS first developed and used as a machine to produce x-rays. The acceleration process for producing a free beam of electrons or a beam of x-rays is the same. In either case a quantity of electrons from a hot tungsten filament is injected into a vacuum chamber between

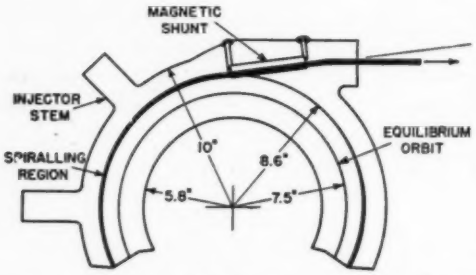

Fig. 1. Drawing of the vacuum chamber of the betatron, showing the equilibrium orbit, spiralling region, and magnetic shunt.

the poles of an alternating current electromagnet. A fraction of the injected electrons are captured in circular orbits. Here they receive energy from the increasing magnetic field, gaining about 70 electron volts per turn and making about 300,000 turns to reach full energy in the case of the 20 Mev. machine. After the required energy is reached, the diameter of the electron orbit is expanded.

To produce x-rays the electrons are made to strike a platinum target. To produce a free beam of electrons from the betatron, it is necessary to have an unobstructed path for the electrons. Therefore, the target was removed and the injector placed above the plane of the electron orbit. The electrons during expansion of the orbit move out past and under the injector and reach a region near the edge of the magnetic field, where they start moving in spirals of large pitch. If nothing further were done, the

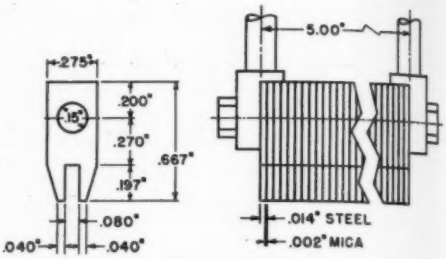

Fig. 2. Drawing of the magnetic shunt used to get a free beam of electrons from the betatron.

electrons would continue spiralling and come out through the walls of the vacuum chamber as a spray in all directions about the machine. However, a magnetic shunt is placed at the beginning of the spiralling region, as shown in Figure 1. This produces a region throughout the length of a channel cut in its face in which the magnetic field is nearly zero. The electrons enter this region and move nearly in a straight line for a distance of 10 cm. They emerge in a field which is so weak that they receive only slight magnetic deflection before they pass through the window of the vacuum chamber and escape entirely from the influence of the magnetic field.

Figure 2 illustrates the construction of the magnetic shunt. It is placed inside the vacuum chamber with the narrow dimension of the channel in the vertical direction and the open edge of the channel facing the center of the electron orbits. The lines of magnetic flux, which are vertical in the machine, essentially follow the iron around the channel, thus leaving only a small field in the channel. Figure 3 shows the vacuum chamber used, hereafter referred to as the donut. Figure 4 shows the window of the donut. The magnetic shunt can be seen through the 2-mm. glass forming the window. Figure 5 is a photograph of a section through the donut, showing the injector and its position above the median plane in which the electrons move.

The method of removing the electron beam described above worked almost immediately on the first trial. After a slight amount of adjustment, a well collimated beam of electrons was obtained. The

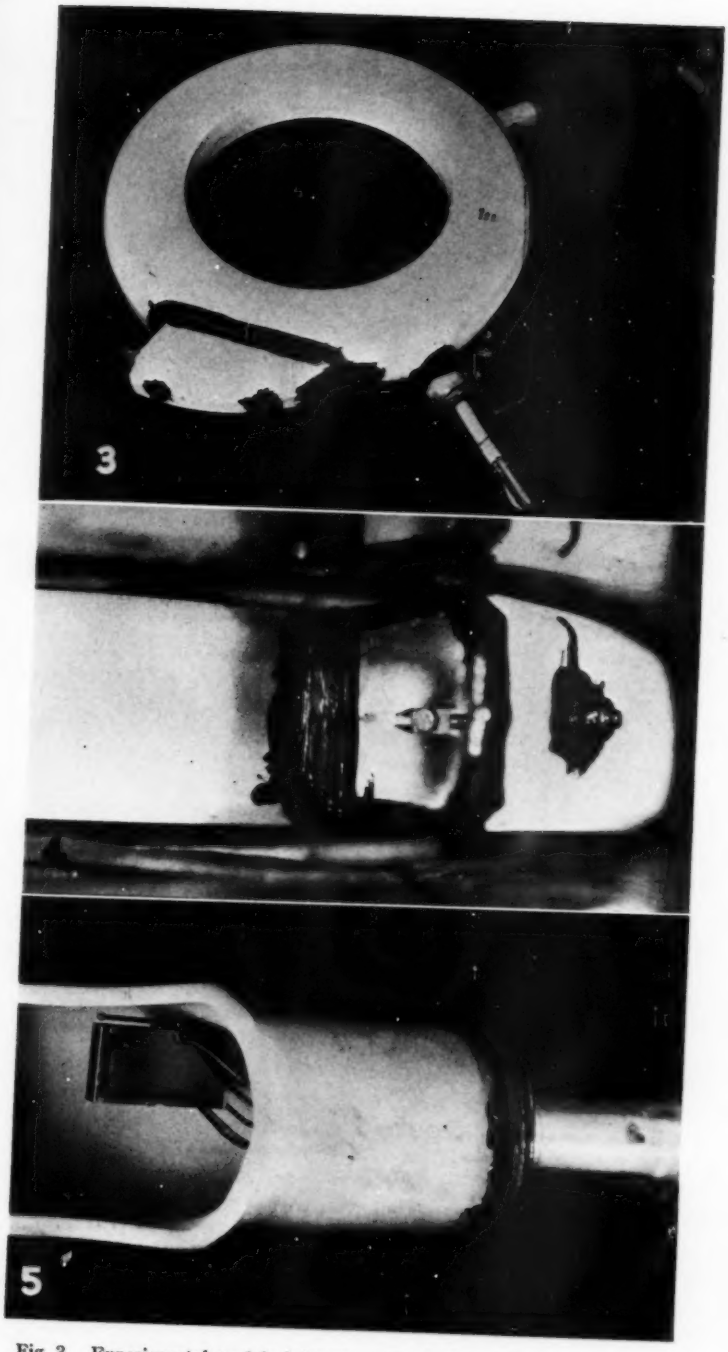

Fig. 3. Experimental model of the vacuum chamber, called a donut.
Fig. 4. Side view of the electron donut showing the window through which the electrons pass. The magnetic shunt is visible through the window. A discoloration of the glass window due to the electrons is visible on the inside edge in the median plane.
Fig. 5. A cross section of the donut showing the relative position of the electron injector.

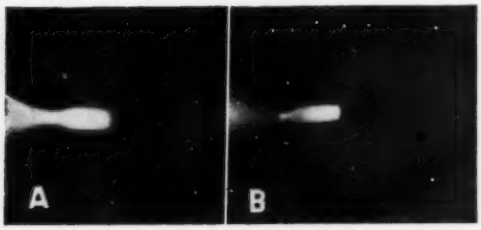

Fig. 6. A. The electron beam cross section taken with a film in contact with a 2-mm. glass window. B. The electron beam cross section taken with a film in contact with a window of 0.001 inch of aluminum.

most intense beam yet observed produced an ionization, in a Victoreen thimble chamber at a distance of one meter from the window, equivalent to that produced by 100 r per minute of x-rays. At 35 cm. from the window an equivalent of 1,500 r per minute with an 8-sq. cm. field was observed. It is expected that the intensity can be improved by a factor of 10 or 100.

The main part of the beam of electrons as it emerges from the window has a height of about 2 mm. and a width of about 6 mm. Figure 6, A shows the cross-sectional shape of the beam as it emerges from a window of glass 2 mm. thick. The fan-shaped tail is produced by electrons which are not completely captured by the magnetic shunt. Figure 6, B shows the cross-sectional shape of the beam as it emerges from an aluminum window 0.001 inch thick. Note that the outline of the beam is much sharper than in Figure 6, A and that much of the tail which passed through 2 mm. of glass is indistinct.

The beam suffers considerable scattering in the air beyond the window. Figure 7, A shows the cross-sectional shape of the beam at a distance of 10 cm. from the 0.001-inch aluminum window. The beam no longer has the sharp outline of the beam at the window, the edges now having become diffuse. The height is about 6 mm. and the width about 13 mm. Figure 7, B shows the cross-sectional shape of the beam at 35 cm. The beam is about 2 cm. high and about 4 cm. wide at this point. At one meter the beam has a mean diameter at the position of half maximum intensity of about 12 cm.

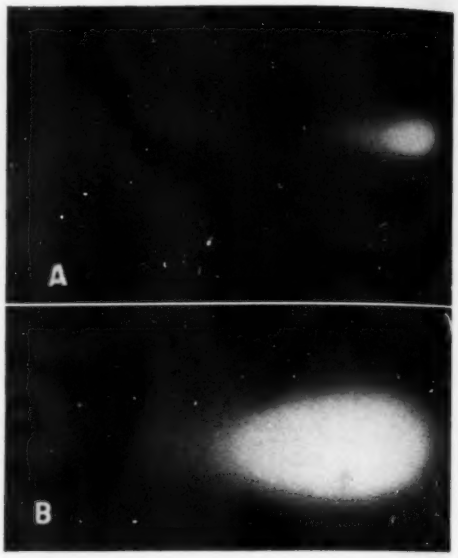

Fig. 7. A. The electron beam cross section taken with a film 10 cm. from a 0.001 inch aluminum window. B. The electron beam cross section taken with a film 35 cm. from a 0.001 inch aluminum window.

However, if the beam is allowed to enter another evacuated space immediately after emerging from the donut, the divergence is just that calculated for multiple scattering in the two aluminum windows through which it passes. This indicates that the beam leaving the magnetic shunt has a very small divergence and that, if the evacuated donut were extended some distance in the direction of the beam, the beam would remain small and well defined.

The beam does not produce sufficient ionization in air to be self-luminous. Its path can be made visible, however, by placing a fluorescent screen in the beam at a slight angle to the direction of the beam. Figure 8 is a photograph of the beam striking such a fluorescent screen. The betatron and the operator's hand pointing out the position of the window of the donut were superimposed on the photograph by making a second exposure under incandescent light after the machine was turned off.

The penetration of the beam was determined by sandwiching a sheet of film between two pieces of presdwood of density

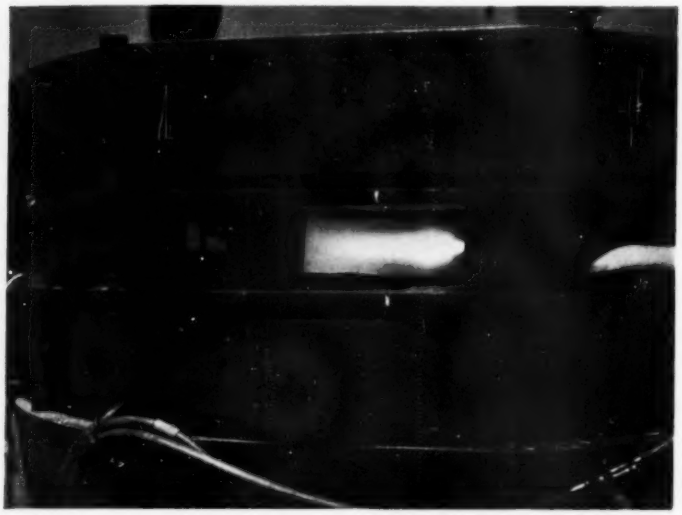

Fig. 8. Fluorescent screen showing the path of the electrons as they emerge from the donut.

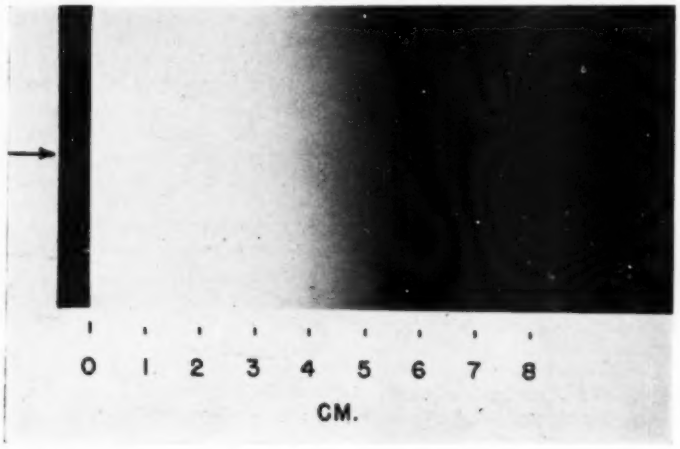

Fig. 9. A film sandwiched between two presdwood boards shows the penetration of 13-Mev. electrons. The arrow shows the direction of the electron beam.

equal to that of water. The edge of the film was coincident with that edge of the presdwood blocks which faced the beam, and the plane of the film was approximately parallel to the beam. Figure 9 shows the resulting exposure of the film by a 13-Mev. beam of electrons. The extreme penetration of the beam was 6 cm., which is in agreement with the theoretical predictions. This theory predicts 14.5 cm. penetration for a 30-Mev. beam and 17.0 cm. for 35 Mev. The depth dose has not yet been measured, but from theory we expect in general a slight increase of ionization from the surface to a point near the end of the range and then a sharp decrease to practically zero ionization. This has actually been observed in a qualitative way by one of us (Kerst) using the scattered spray of electrons from an x-ray producing target.

The exit dose is very small for an electron beam. It was measured behind 10 cm. of presdwood, which was 4 cm. more than that necessary to stop the 13-Mev. beam. The ionization was found to be about 1 per cent of that at the front surface of the presdwood.

Collimation of a beam of electrons is relatively simple. Lead, however, is not a satisfactory material for collimation, since a large yield of x-rays is obtained when it is struck by high-energy electrons. As the efficiency of x-ray production decreases rapidly with decreasing atomic number, materials of low atomic number, such as the hydrocarbons, are indicated. Thus wood and plastics are the most economical and satisfactory.

Considerable work remains to be done before the betatron can be used in the treatment of cancer by electron therapy, but it has been demonstrated that a well collimated beam of electrons, homogeneous in energy and of sufficient intensity, can be produced by the betatron.

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DISCUSSION

Edith H. Quimby, D.Sc. (New York, N. Y.): Almost twenty years ago, when Brasch and Lange first produced their penetrating cathode rays, some of us saw some specimens of plastic which they had irradiated, in which the surfaces were unchanged but in which visible effects had occurred at depths of a few millimeters. We were impressed. They were scientific curiosities.

Some years later, when the group at the Massachusetts Institute of Technology produced their penetrating cathode rays, one of their very striking exhibits was a pad of scratch paper which had been put under the target; looking at the surface of the pad, one could see no effect, but on turning over the pages, after a few sheets a little scorching began to be evident and after a few more there was almost a hole burned in the paper. That is an extremely impressive demonstration of what can be done to organic material by penetrating cathode rays.

The trouble was that those rays, at two or three million volts, penetrated only two or three millimeters of tissue. We said, "Wouldn't it be wonderful if we could get more penetrating cathode rays which we could direct to any region within the body? They would go through the superficial tissue, producing no effect, give up their ionization at the end of the range, and do their work there." You all remember the very interesting slide that Dr. Newell showed at the Carman lecture[1] for electrons of various voltages, in every case giving up much more energy close to the end of the range. Now, with the betatron, we have cathode rays at twenty or thirty million volts, a penetration of up to 13 or 14 cm. in tissue, which ought to reach almost any malignant lesion provided the beam is properly directed.

It would seem, then, that we have an instrument for putting our energy right where we want it. That means, of course, that the radiologist has to find out much more definitely than he ever did before right where it is that he does want it. Heretofore he has exposed a patient to an external beam of x-rays and he has hoped that the lesion lying somewhere within that beam would get an adequate dose. He has estimated the depth of the tumor as 5 or 7 or 10 cm., calculated the tumor dose for that depth, and felt that he was getting adequate information about the amount of radiation reaching the tumor. With these cathode rays, it is necessary to know the location more precisely, and that means we must make much more careful measurements of the patient and plan the treatment much more carefully.

The fact that the radiation for any specified voltage penetrates to some definite depth means that we must have a knowledge of what voltage we should use in a particular case. We will have to have a variable voltage instrument so that we can get to 5 cm. and not farther, 7 cm. and not farther, or whatever the particular depth may be.

The betatron is at the present time not a therapeutic instrument; for that, it will have to have modifications. However, work which has just been presented to us is fascinating in the new field that it opens up, the possibilities for therapy of a sort that we have visualized as desirable and hoped for some time in the future. Now it looks as though we might be going to have it soon.

Robert R. Newell, M.D. (San Francisco, Calif.): When x-rays are absorbed, they turn themselves into beta rays. Now by using beta rays themselves we have an opportunity to put these biologic effects in exactly the place that we want to. It is going to be, as Dr. Quimby just said, an extraordinarily difficult and delicate clinical operation. And we shall be able to study the biologic importance of columnar density of ionization, which we have never been able to do with the certainty what we would wish.

It is well known that the ulcerations following overdoses of x-rays are due to a combination of the damage by the x-rays themselves and the influence of the inevitable infection of the denuded surface.

[1] Radiology **48:** 215–231, March 1947.

If you irradiate a large open wound, even with 2,000 r in a single sitting, and then pull the unirradiated skin over it so that the irradiated area gets no further damage by superficial infection—that is, if you protect it by pulling normal skin over it—you can have a patient go through such an x-ray reaction without any ulceration and without any necrosis, even though the dosage is great enough to produce a sterile necrosis and pathological fractures in the ribs. I have seen such cases. It is possible, then, that by using beta rays, with which you do not produce a denudation of the overlying skin, you can use much larger tissue doses in attacking cancer than you can with x-rays. That offers a very great clinical opportunity as well as an experimental opportunity.

L. S. Skaggs, Ph.D. (*closing*): Like Dr. Quimby, I was much impressed by some of the earlier demonstrations, particularly those in which electrons penetrated a paper pad, producing their greatest effect at a distance below the surface. It was that demonstration which led us to think of trying to use the betatron for electron therapy

I appreciate Dr. Quimby's mentioning the work which radiologists must do and the care which they must use in applying betatron therapy. It is going to open up an entirely new field and will require a great deal of work by radiologists before it can be successfully applied on a wide scale. We can certainly hope that progress will be faster than it was in the case of x-rays, because we have all the present background to work with.

It will certainly be necessary for a great many institutions and a great many radiologists to do research in the field of electron therapy before it can be successfully applied. We are going ahead at Michael Reese, but we hope to see many other institutions also starting a program of work in the use of electrons for therapy.

SUMARIO

Adaptación del Betatrón para la Electronoterapia

En la Introducción de este trabajo señálase que, en contraposición a los rayos X o los rayos gamma del radio, un haz de electrones veloces tiene su energía concentrada, no en el foco, sino en el extremo del haz. Además, el haz se encuentra limitado en su alcance por el voltaje utilizado en su producción. Con la electronoterapia parece, pues, posible concentrar casi toda la energía radiante en la lesión por tratar, sin irradiar el tejido adyacente o subyacente y produciendo efectos relativamente ligeros en el subyacente.

Los AA. describen un método para obtener un haz bien colimado de electrones, del betatrón. Esto exige eliminación del anticátodo, colocación del inyector más arriba del plano de la órbita de los electrones e introducción de un desviador magnético en la cámara de vacío, según indican los grabados. El haz más intenso obtenido en esa forma produjo una yonización equivalente a la producida por 100 r de rayos X por minuto en una cámara de dedal Victoreen a 1 metro de la ventana. A 35 cm. de distancia de la ventana observóse el equivalente de 1,500 r por minuto con un campo de 8 cm.^{2} Con un haz de 13 Mev. de electrones, la penetración máxima fué de 6 cm. Cálculos teóricos dan una penetración de 14.5 cm. para un haz de 30 Mev. y de 17 cm. para 35 Mev.

Sin embargo, queda aun mucho por hacer antes de poder utilizar el betatrón para la electronoterapia del cáncer.

Differential Diagnosis of Retrocardiac Shadows[1]

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THE CONFIGURATION of the cardiac shadow as observed on a routine roentgenogram of the chest was given adequate emphasis and the findings were correlated with electrocardiograms by Master (19), but the variations in density within the triangular shadow have received, in the past, very little consideration unless there was an obvious fluid level or an impressive calcification. Systematic analysis of the triangular shadow will frequently disclose considerable variations in density, many of which present characteristic features of diagnostic importance or give additional clues which may lead to other diagnostic procedures and aid in differential diagnosis and detection of asymptomatic retrocardiac lesions.

The space-occupying lesions located in the upper half of the mediastinum produce pressure signs relatively early and are frequently suspected by the clinician. In the retrocardiac region, where the space is wide, the most obscure thoracic lesions occur, and these must reach considerable size before they lead to clinical signs and symptoms. By early detection and proper evaluation of the abnormal retrocardiac shadows, the radiologist may establish the diagnosis before the clinical signs and symptoms of compression of large blood vessels and nerves become apparent.

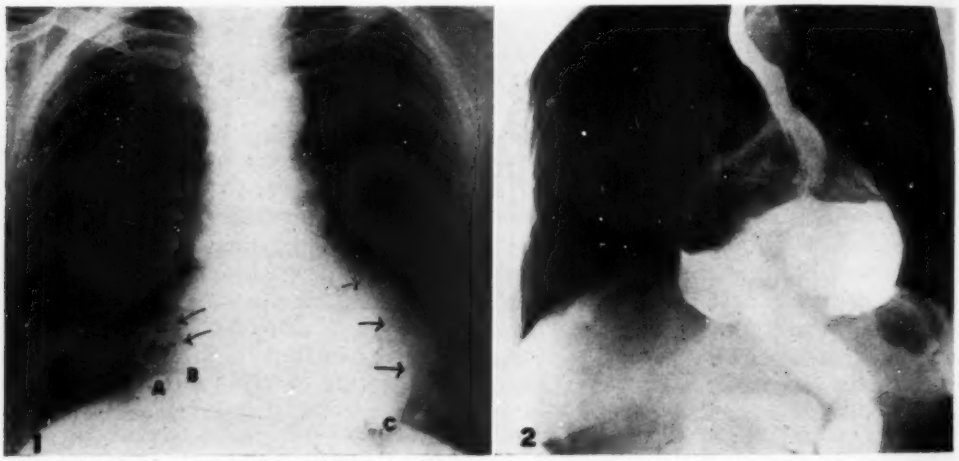


Fig. 1. Duplication of the cardiac shadow produced by stomach in the retrocardiac region. Note the convex lines A, B, C, within the cardiac shadow.

Fig. 2. After the administration of barium, the stomach and the lower esophagus are visualized within the silhouette of the cardiac shadow.

THE CARDIAC SHADOW

The pericardium and the heart cast a triangular shadow on a postero-anterior roentgenogram of the chest. The heart shadow is not visible within the larger silhouette of the pericardium as a central nuclear shadow, since the pericardial cavity

[1] From the Departments of Radiology of the St. Louis City Hospital and St. Louis University School of Medicine, St. Louis, Mo. Presented by invitation at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–6, 1946.

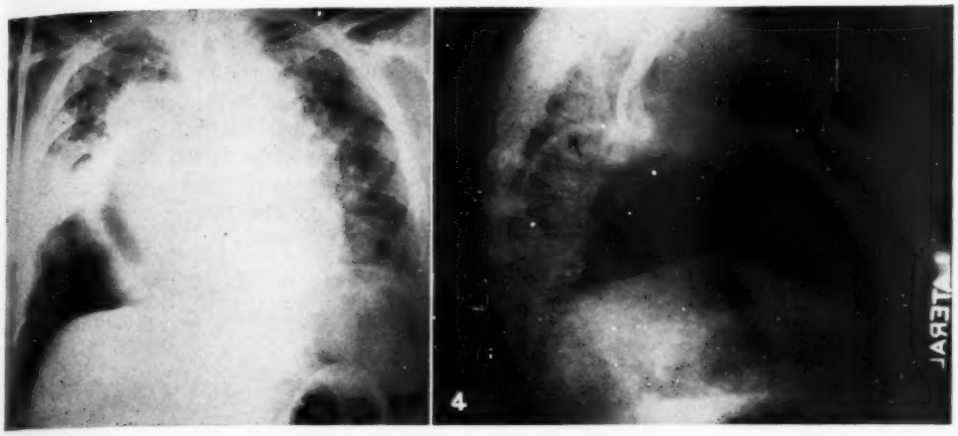


Fig. 3. A halo within the cardiac shadow is produced by the gas-distended stomach in the retrocardiac region. Note the coiling of the catheter in the kinked esophagus. The pneumoperitoneum was spontaneous and due to a ruptured diverticulum of the sigmoid.

Fig. 4. Lateral view showing the gas-distended stomach in the retrocardiac region.

is only a potential space. Under normal conditions, the serous layer of the pericardium is everywhere in contact with the serous layer of the epicardium, the contact surfaces being moistened by a slight amount of serous fluid, as pointed out by Gray and Lewis (10). The central nuclear area of the cardiac shadow shows the greatest opacity, but without the use of a contrast medium the individual chambers of the heart are not ordinarily visualized. The apex of the heart may be seen, and the adjacent triangular area of decreased density is thought to be due to a fat pad. Numerous pulmonary markings extending obliquely from the hilus toward the diaphragm are superimposed over the left peripheral portion of the cardiac shadow, and a few markings are seen on the right. On a slightly over-penetrated roentgenogram the course of the descending aorta, the paraspinal shadows, and the vertebral column are demonstrable. The presence of other shadows within the cardiac silhouette deserves special investigation.

Holmes (12) proved experimentally that the heart shadow cannot be seen distinctly within the larger silhouette of a pericardial effusion. Apparent duplication of the cardiac shadow, therefore, is due to other diseases.

DISEASES OF THE STOMACH PRODUCING RETROCARDIAC SHADOWS

The apparent duplication of the cardiac shadow (Fig. 1), which gives the impression of the heart visible within the pericardium, is usually due to herniation of the stomach through the diaphragm, or to the extremely rare condition of thoracic stomach with congenitally short esophagus. The clinical history may be entirely negative or misleading and suggestive of primary heart disease. Examination after a barium meal (Fig. 2) confirms the presence of the stomach in the retrocardiac region.

A large hernia of the stomach through the esophageal hiatus usually produces an area of opacity with an apparent duplication of the cardiac shadow. A lateral roentgenogram of the chest may or may not show a definite retrocardiac opacity, but the barium meal confirms the diagnosis. In cases associated with intestinal obstruction and spontaneous pneumoperitoneum, a halo (Fig. 3) is seen within the cardiac shadow, but the lateral roentgenogram (Fig. 4) showing the gas-distended stomach in the retrocardiac region establishes the diagnosis of herniation of the stomach.

The presence of multiple convex lines (A, B, C, Figs. 1 and 5) outlining the dome-shaped retrocardiac opacity constitutes an

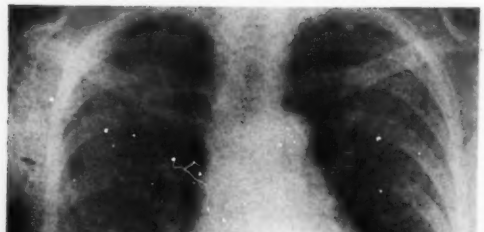


Fig. 5. Duplication of the cardiac shadow produced by the stomach in the retrocardiac region. Note the convex lines, A, B, and C, and compare with Figures 6 and 7. The aortic shadow is displaced to the left and superimposed on the line B.

important diagnostic sign, indicating that the stomach is in the retrocardiac region. These convex lines show the thickness of the peritoneal sac and the stomach wall, which can be demonstrated by the use of the double-contrast method. This sign, when seen on a postero-anterior roentgenogram of the chest indicates the presence of the stomach in the retrocardiac region. Over-penetration will readily demonstrate the sign, but it may not appear obvious on an under-penetrated roentgenogram. The sign was observed in large hiatal hernias of both the sliding and fixed variety. The presence of the hiatal hernia can be confirmed by administration of barium.

From the therapeutic standpoint, the diagnosis of fixed or non-sliding hiatal hernia of the stomach is not adequate. It is essential to visualize adequately the lower third of the esophagus and the stomach, in order to differentiate between the thoracic stomach with a congenitally short esophagus and a true hiatal hernia with the esophagus of normal or adequate length, as pointed out by Clerf *et al.* (7). The difficulties encountered in this differentiation have been well summarized by Bockus (4), who stated that in his experience it may in some cases prove to be extremely difficult and in others impossible, even with the assistance of the esophagoscopist. The difficulties encountered by the esophagoscopist in the study of the lower end of the esophagus have been clearly stated by Mosher and McGregor (20), who say: "It is difficult to be sure of what you see at the end of a 21-inch tube large or small and it is equally hard not to see what your mind has been made up to see."

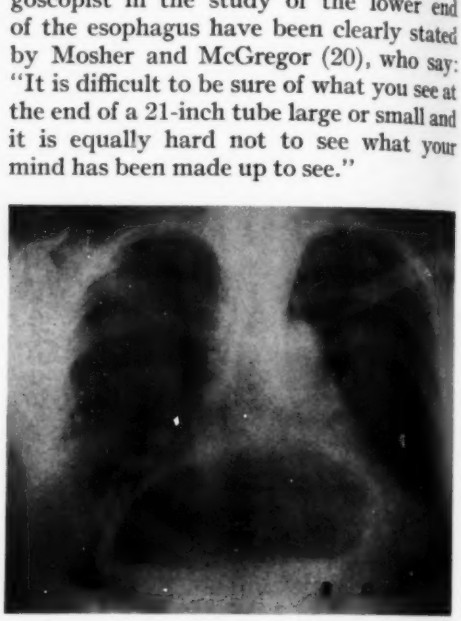


Fig. 6. Gas-distended stomach with a fluid level seen through the cardiac shadow after the administration of highly carbonated soda water. Note the lines B and C within the cardiac shadow. Distended wall of the stomach extends beyond the right cardiac margin.

Allison *et al.* (1) have devised a special pair of forceps with which a silver Cushing's brain clip can be attached to the suspected cardio-esophageal junction through the esophagoscope. A biopsy is taken at the same time to establish the microscopic structure. The chest radiograph will show the location of the metal clip.

Double-Contrast Method: The difficulty encountered in visualizing and determining the length of the lower part of the esophagus and establishing the relationship to the stomach, in obese patients with the stomach in the retrocardiac region, is due to inadequate contrast and the superimposition of the shadows of the heart, stomach, esophagus, and spine. By utilizing the gaseous properties of carbon dioxide present in ordinary soda fountain water, adequate contrast can be secured.

The patient is examined in a fasting

state and, after the preliminary fluoroscopic study, 8 to 16 ounces of cold, highly carbonated soda water are administered. An adequately distended stomach (Fig. 6) can immediately be seen fluoroscopically, and its relationship to the surrounding structures can be determined. Subsequent administration of barium (Fig. 7) will outline the course and the displacement of the esophagus. Roentgenograms are made in the positions which will best demonstrate the length and the course of the esophagus. A lateral roentgenogram may be necessary to show the length.

The rapidity of passage of barium through the lower third of the esophagus can be decreased adequately by examining the patient in Trendelenburg decubitus and utilizing a thick barium mixture.

DISEASES OF THE ESOPHAGUS PRODUCING RETROCARDIAC SHADOWS

Megaesophagus produces widening or reduplication of the right cardiac contour and obliteration of the right cardiophrenic angle. The opacity has a slightly convex right-sided border and frequently produces

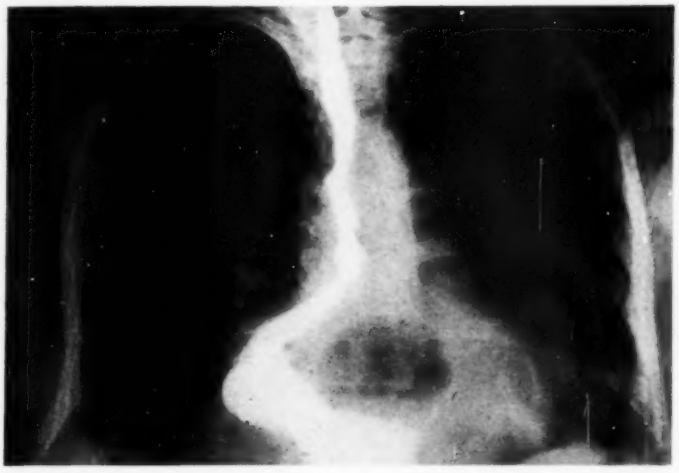


Fig. 7. The course and displacement of barium-filled esophagus with dilated ampulla in a case of hiatal hernia as shown with double-contrast method. The gas-distended stomach is seen through the central area of the cardiac shadow.

The cardio-esophageal junction can be seen when a small amount of barium is administered after gaseous distention of the stomach (Fig. 8), but a better view is secured by placing the patient with the gas- and barium-distended stomach in the horizontal or Trendelenburg oblique or lateral position. The barium will displace the gas from the fundus of the stomach and cause gaseous distention of the lower third of the esophagus. An additional barium swallow will trap the gas in the lower third of the esophagus, and the cardio-esophageal orifice can be seen end on (Fig. 9).

a uniform widening of the right half of the mediastinal shadow. The wall of the esophagus can often be seen extending above the clavicle. The right-sided widening of the mediastinum is characteristic of megaesophagus, whereas aortic aneurysms, tortuous aorta, and the retrocardiac stomach produce predominantly left-sided widening. Barium will outline the esophagus.

Hurst *et al.* (13) observed an apparent reduplication of the cardiac contour on the right in ten out of eleven cases of megaesophagus diagnosed from chest roentgenograms. This was best demonstrated on

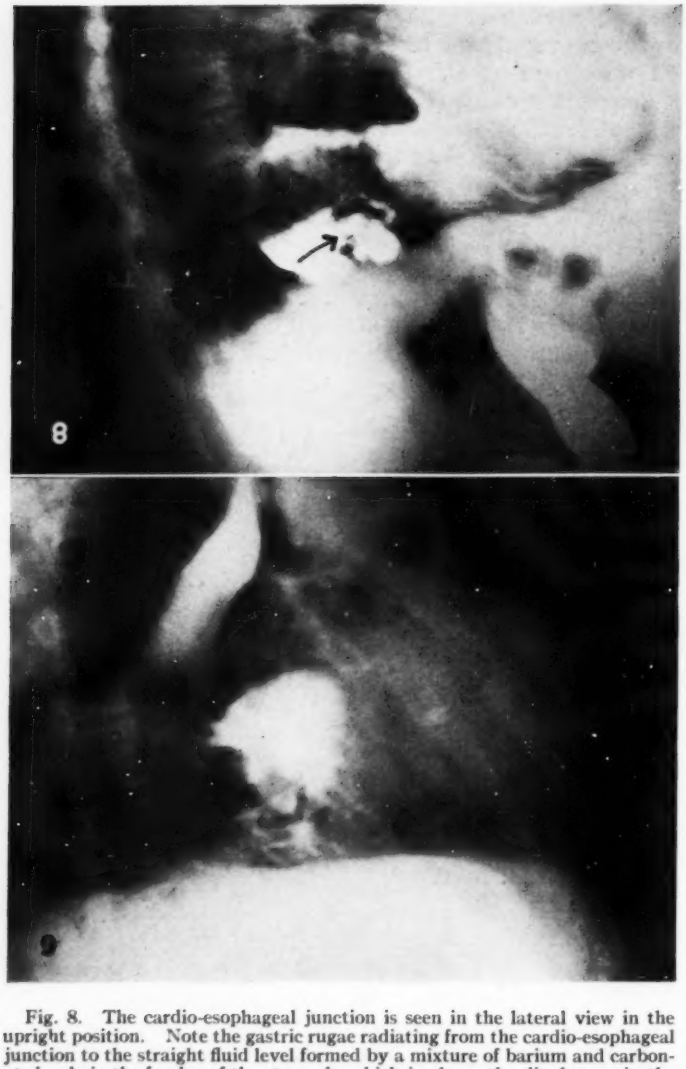


Fig. 8. The cardio-esophageal junction is seen in the lateral view in the upright position. Note the gastric rugae radiating from the cardio-esophageal junction to the straight fluid level formed by a mixture of barium and carbonated soda in the fundus of the stomach, which is above the diaphragm in the retrocardiac region.

Fig. 9. The cardio-esophageal junction is seen end on in the oblique view with the patient lying down. In this position the gas from the fundus of the stomach in the retrocardiac region is displaced by barium. An additional barium swallow traps the gas in the lower esophagus.

roentgenograms with slightly increased penetration.

A large *esophageal diverticulum* may produce a retrocardiac shadow. Its mobility differentiates it from tumors and aneurysm. In a series of six diverticula reported by Janes (14), two could be suspected from the roentgenogram of the chest.

Mediastinal cysts of enteric origin produce roughly spherical opacities of homogeneous density which may extend beyond the cardiac outline. The cysts arise in the posterior mediastinum, most commonly in the middle third, but their occurrence in the retrocardiac region has been reported by Ladd *et al.* (17). These cysts occur in

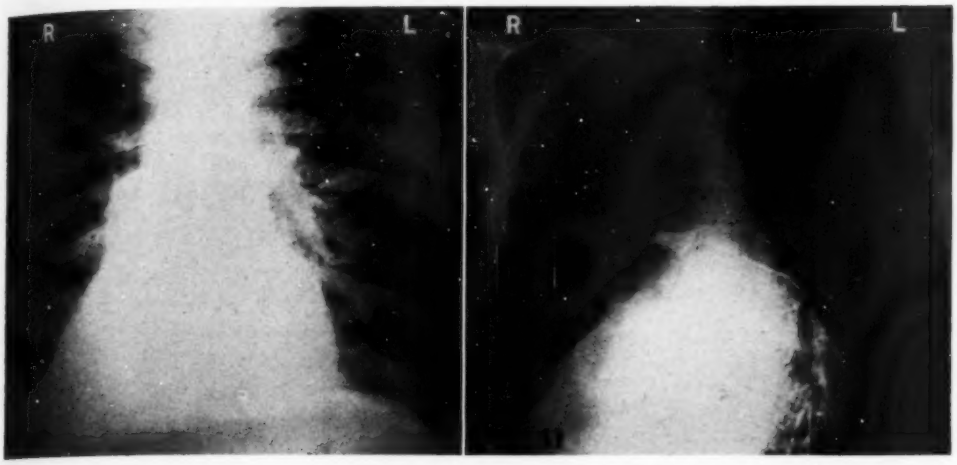


Fig. 10. Atelectasis of the right lower lobe producing a retrocardiac shadow with obliteration of the right cardiophrenic angle, simulating the appearance of dextrocardia. (Courtesy of Dr. J. J. Hammond.)
Fig. 11. Bronchogram, over-penetrated, outlining the obstructing neoplasm. (Courtesy Dr. J. J. Hammond.)

infancy and early childhood and may produce pulmonary compression and occasionally may erode the ribs and even be associated with abdominal cysts, as reported by Nicholls (22).

DISEASES OF THE LUNGS PRODUCING RETROCARDIAC SHADOWS

Complete *atelectasis* of the lower lobes presents a well known characteristic triangular retrocardiac opacity, which obliterates the cardiophrenic angles. Occasionally, however, a dense retrocardiac shadow overlaps the right side of the cardiac shadow, giving the appearance of dextrocardia (Fig. 10). Bronchography and over-penetrated films (Fig. 11) will outline an obstructing neoplasm producing atelectasis.

Bronchiogenic cysts appear as round, uniform homogeneous opacities, usually in the upper two thirds of the mediastinum. Rounded retrocardiac shadows due to bronchiogenic cysts and visible through the cardiac shadow were observed twice by Brown and Robbins (5) in a series of twenty-one cases.

A large *tuberculoma* of the posterior mediastinum producing a retrocardiac mass casting a shadow suggestive of an aneurysm of the descending aorta was reported by Blades *et al.* (3).

Ecchinococcus cysts are usually large and extend well beyond the cardiac outline. Young cysts are demonstrable as rounded, well defined shadows, the older cysts have an indistinct, feathered outline, as pointed out by Evans (8) A pericystic, crescentic shadow is produced by older cysts associated with bronchial fistula.

Other lesions of the lungs and pleura may produce variations in density of the right and the left sides of the heart. Rigler pointed out the importance of the study of variations in density of the cardiac shadow in the early diagnosis of lobar pneumonia of the lower lobes, localized bronchiectasis, lung abscess, and mediastinal pleural effusion (23, 24).

The significance of defects in the contours of the retrocardiac pulmopleural demarcation lines and the technic of visualization of these lines were described by Billing (2).

DISEASES OF THE SPINE PRODUCING RETROCARDIAC SHADOWS

Tuberculosis of the spine with associated paravertebral abscess is the most common cause of abnormal rounded or fusiform retrocardiac shadows in children. The

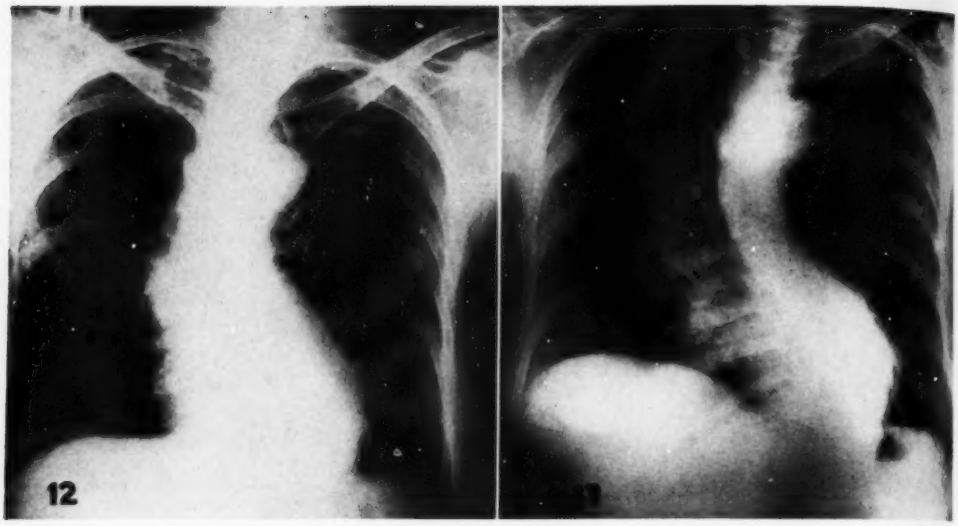


Fig. 12. Duplication of the left cardiac margin produced by a retrocardiac shadow.
Fig. 13. Over-penetration establishes the presence of scoliosis.

typical narrowing of the intercostal spaces and associated kyphosis make the diagnosis obvious.

In adults (Fig. 12), *scoliosis* frequently produces duplication of either the left or the right cardiac margin. Marked compensatory narrowing of the intercostal spaces, when present, makes the diagnosis obvious. If the narrowing is only minimal, an over-penetrated roentgenogram (Fig.13) establishes the diagnosis.

Tumors of neurogenic origin usually appear as single, sharply outlined, rounded or oval non-pulsating shadows on one side of the vertebral column; they may occasionally occur in the retrocardiac region and be visualized through the cardiac shadow (Lerman, 18). Kent *et al.* (15) pointed out that the lobulated appearance of a neurogenic tumor is strongly suggestive of rapid growth and therefore malignancy. Naffziger *et al.* (21) emphasized the need of roentgenographic study of intervertebral foramina, interlaminal and interspinous spaces, to detect areas of erosion produced by hourglass tumors.

Sympathicoblastoma occurring in children may produce a round or fusiform retrocardiac shadow, which may extend even beyond the cardiac outline. Chandler *et al.* (6) observed the destruction of the pedicles and sclerosis of the body of the vertebra adjacent to sympathicoblastoma. Two of four cases reported by these authors presented retrocardiac shadows.

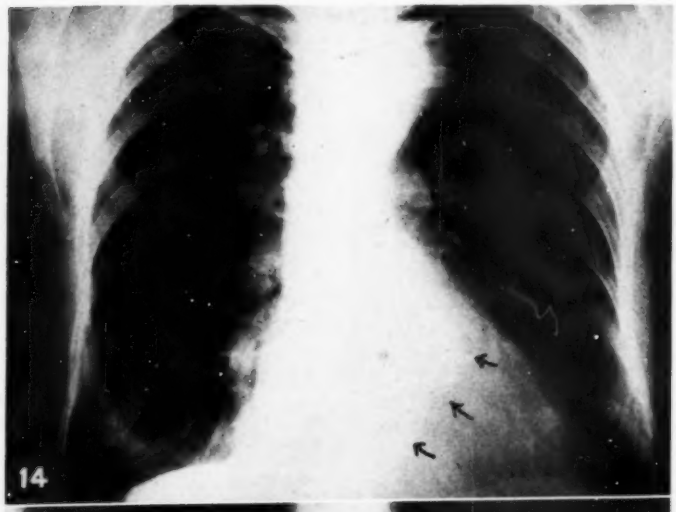
A case of *fibrosarcoma* producing a round retrocardiac shadow was reported by Harrington *et al.* (11).

CARDIOVASCULAR DISEASES PRODUCING RETROCARDIAC SHADOWS

Aneurysm of the descending aorta may be visualized through the left half of the cardiac shadow as a fusiform or globular area of opacity and may produce duplication of the cardiac shadow, as reported by Freedman (9). The presence of longitudinal, peripheral calcifications outlining the wall of the aneurysm is of diagnostic importance in non-pulsating aneurysms of the descending aorta. Bone erosion is diagnostic, but occurs in the late stage of the disease. Diodrast injection will establish the diagnosis in doubtful cases.

The *elongation of the aorta* seen in old people as a left-sided convex retrocardiac shadow is well known.

Congenital elongation and tortuosity of



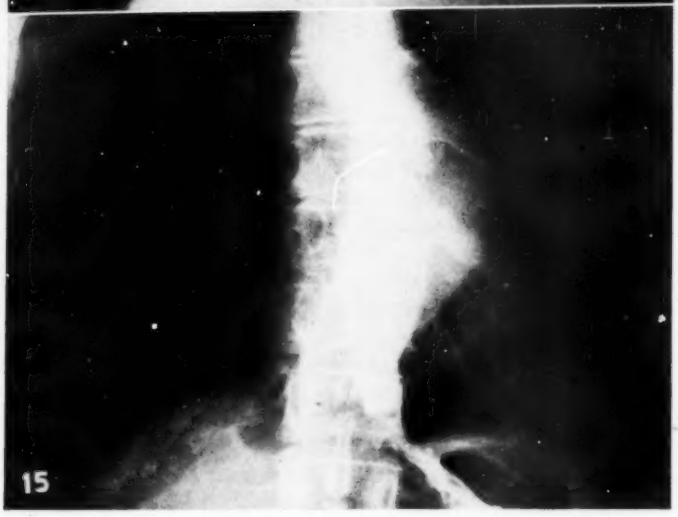


Fig. 14. A convex retrocardiac shadow located in the course of the descending aorta, visible through the left half of the cardiac shadow and suggestive of an aneurysm. Note the marked displacement of the aortic knob into the left lung field.

Fig. 15. Over-penetration establishes the diagnosis of extreme tortuosity and elongation of the aorta.

the aorta is characterized by marked displacement of the aortic knob, which extends well into the left lung field. A rounded or oval mass in the course of the descending aorta may be present and will cast a retrocardiac shadow suggestive of an aneurysm (Fig. 14). The course of the aorta can be demonstrated by over-penetration (Fig. 15). Khoo (16) observed a "tortuous knob" which extended well into the upper left lung field in a twelve-year-old boy, but he did not observe the retrocardiac shadow. In his search through the literature he was unable to find a similar case.

The possible presence of two diseases in the same individual should be considered, and adequate investigation of the retro-

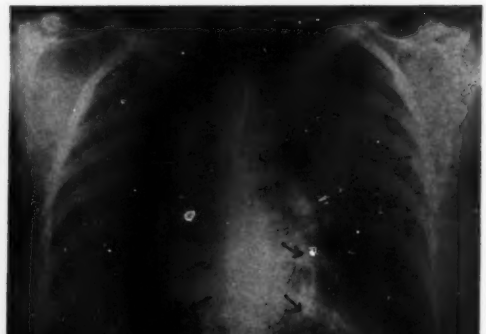


Fig. 16. A rounded shadow visible within the cardiac silhouette is due to the enlarged left atrium, which appears as a distinct chamber of the heart. Note the oblique course of the right and the left bronchus just above the enlarged left atrium.

cardiac shadows even in the presence of obvious widening of the aortic arch and a positive serologic test is essential, since the globular retrocardiac shadow may be due to a hiatus hernia rather than the suspected aneurysm, as shown by the double-contrast method.

An *enlarged left atrium* can be visualized as a distinct chamber of the heart within the cardiac shadow by utilizing adequate penetration. It appears (Fig. 16) as an opacity with a caudal convexity in the upper part of the cardiac shadow. The cases with auricular fibrillation present very sharply outlined left atria. The location of the shadow and the mitral cardiac configuration establish the diagnosis.

SUMMARY

Certain diseases of the stomach, esophagus, aorta, heart, lungs, and vertebral column cast characteristic retrocardiac shadows, which may not project beyond the cardiac outline, but can be recognized as variations in density within the cardiac shadow.

A diagnostic sign consisting of multiple convex lines within the cardiac shadow, indicating the presence of the stomach in the retrocardiac region, is described.

A simple double contrast method for the study of the cardio-esophageal junction and the relationship of the lower third of the esophagus to the stomach is presented.

Diagnosis of asymptomatic retrocardiac lesions may be established by early detection and proper evaluation of abnormal retrocardiac shadows observed on the roentgenograms of the chest.

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DISCUSSION

LeRoy Sante, M.D. (St. Louis, Mo.): First of all, I want to compliment Dr. Nemec on his presentation and on his enthusiasm. He has accumulated a number of interesting conditions, detected by close observation of the heart shadow in ordinary chest films. A second shadow, of retrocardiac origin, may be seen through the heart. I am sure that we would pick up many more such instances, if we would pay closer attention to the possibility of the detection of mediastinal changes in this way.

The fact that in the ordinary roentgenogram of the chest the density of the cardiac shadow is oftentimes sufficient to obscure these things in their entirety should not deter us from investigating suspicious shadows when we see them.

Dr. Nemec has outlined a simple method, involving fluoroscopy in various positions, the barium swallow, and the administration of carbonated water, to help outline this region. It would seem to me that the double-contrast method he outlined—the filling of the stomach with carbon dioxide (ordinary soda pop) so as to clearly outline the fundus, and then the administration of a barium mixture in order to show the lower portion of the esophagus and its relationship to the stomach, its length, etc.—should be most serviceable. I confess that we have all had difficulty at times in determining just exactly what the relationship was between the lower end of the esophagus and the stomach—whether we were dealing with an ordinary hiatus hernia, a true hernia through the leaf of the diaphragm, or a congenitally short esophagus. This, it seems to me, is the main contribution made by this paper.

SUMARIO

Diagnóstico Diferencial de las Sombras Retrocardíacas

Ciertas enfermedades del estómago, esófago, aorta, corazón, pulmones y raquis lanzan típicas sombras retrocardíacas, que a veces no proyectan más allá del contorno del corazón, pero que pueden reconocerse por su distinto espesor en la sombra cardíaca.

Descríbese un signo diacrítico que consiste en una multitud de líneas convexas y denota la presencia del estómago en la región retrocardíaca. Esas líneas muestran el espesor del saco peritoneal y de la pared del estómago.

Ofrécese una técnica sencilla de doble contraste para el estudio de la unión cardioesofágica y de la relación del tercio inferior del esófago con el estómago, consistiendo en la administración de 250 a 500 cc. de agua gaseosa, muy carbonatada, fría, seguida de la administración de bario. El bario desalojará el gas del fondo del estómago, provocando distensión gaseosa del tercio inferior del esófago. Otro trago de bario atrapará el gas en el esófago, permitiendo observar el orificio cardio-esofágico.

Mediante el descubrimiento temprano y la debida justipreciación de las sombras retrocardíacas anómalas observadas en las radiografías torácicas puede establecerse el diagnóstico de las lesiones retrocardíacas asintomáticas.

The Visible Bronchial Tree

A Roentgen Sign in Pneumonic and Other Pulmonary Consolidations[1]

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DURING THE EARLY developmental period of chest roentgenology there was much discussion concerning the anatomical counterpart of the normal lung markings in the roentgenogram. It is now recognized that these normal lung markings are the shadows of vessels, mainly the branches of the pulmonary artery. This has been proved experimentally and is theoretically in harmony with the anatomical and physical facts. The blood-filled vascular tree absorbs more of the rays than the surrounding air-filled pulmonary parenchyma and casts a dark shadow in a well illuminated field. The bronchi are air-filled tubes with thin walls usually too thin to be visible on the film. Since air within the bronchi cannot contrast with air in the surrounding alveolar sacs, the bronchi are not visible.

It may be assumed theoretically that in the presence of pneumonic parenchymal consolidation the air-filled bronchi may become visible as a ramifying system of radiolucent strands within an obscured field. This observation was first made in cases of cylindrical bronchiectasis within chronic atelectasis in children. With improved radiographic technic, the radiolucent bronchial tree was seen more frequently in various types of pneumonia, and this observation was reported in 1927 under the heading: "The Visible Bronchial Tree, a Diagnostic Roentgen Sign of Pneumonia"(1. See also 2 and 3). Although this observation probably has been made by others, it does not seem to be generally known. Since it is thought to be of diagnostic value, our recent experiences as well as an illustrative experiment will be reported.

To elucidate this phenomenon, the following experiment was made. The inside of an open paper box was waterproofed with a thin coating of paraffin. Several paper drinking straws containing air were placed across the box in one direction. Another set of straws, filled with paraffin, was arranged perpendicular to the first set at almost the same depth (Fig. 1), paraffin being chosen because it absorbs x-rays to about the same degree as does water. A roentgenogram of the box was made. The box was then filled with water, to sufficient depth to cover both rows of straws, and another roentgenogram was made. Figure 2,A represents the roentgenogram of the box with both rows of straws, but otherwise empty, *i.e.*, filled with air. The air-filled straws cannot be distinguished, although the original roentgenogram does permit recognition of the fine lines cast by the thin paper walls of the straws. The paraffin-filled straws, on the other hand, are clearly visible. Some

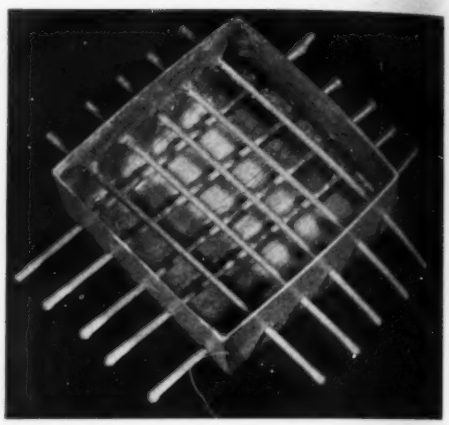

Fig. 1. A waterproofed box with two rows of straws; one set is empty, *i.e.*, air-filled, while the others are filled with paraffin.

[1] From the Department of Radiology, Beth Israel Hospital, and Harvard Medical School, Boston Mass. Accepted for publication in April 1947.

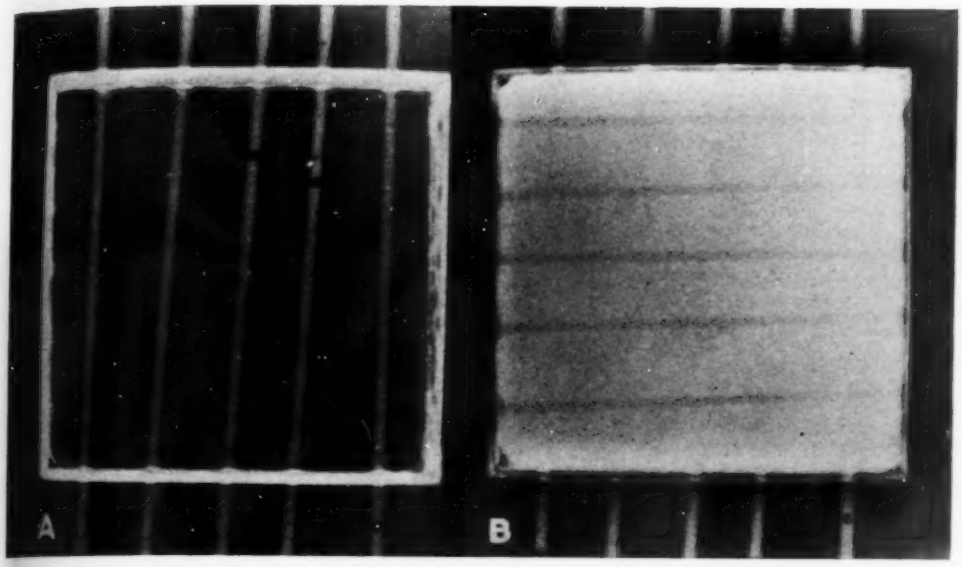

Fig. 2. A. Roentgenogram of the box of Figure 1. The paraffin-filled straws stand out as white bands; the empty straws are invisible except for faint hairlines cast by their delicate walls.
B. Roentgenogram of the same box filled with water. The paraffin-filled straws are now invisible; the air-containing straws stand out as dark bands.

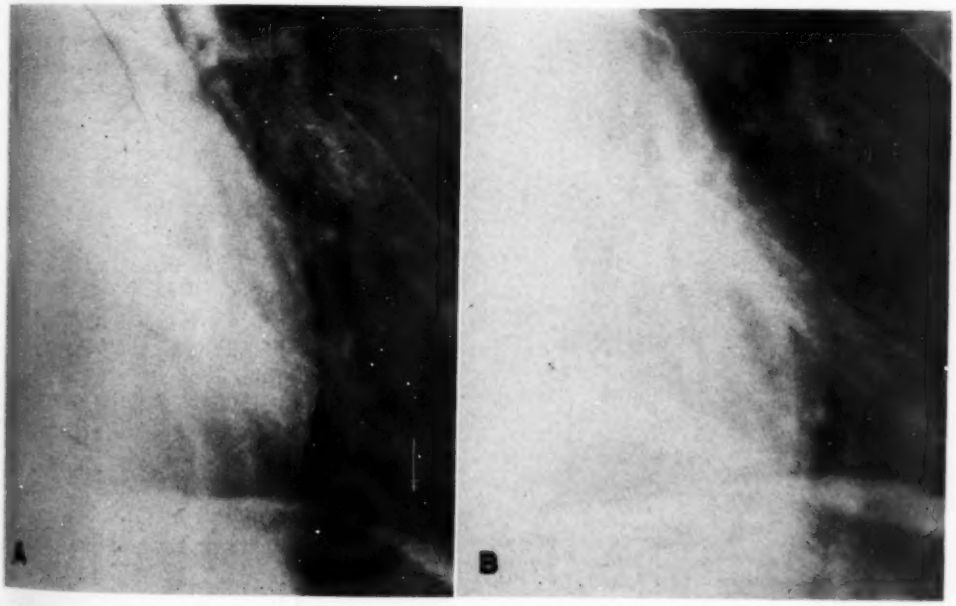

Fig. 3. A. Routine chest roentgenogram, showing the left lower medial portion. The normal lung markings of the lower lobe appear through the heart as white lines.
B. Roentgenogram of the same area in the same individual having a pneumonia in the medial portion of the left lower lobe. The air-filled bronchi are distinctly visible through the heart shadow, indicating pulmonary consolidation in that area.

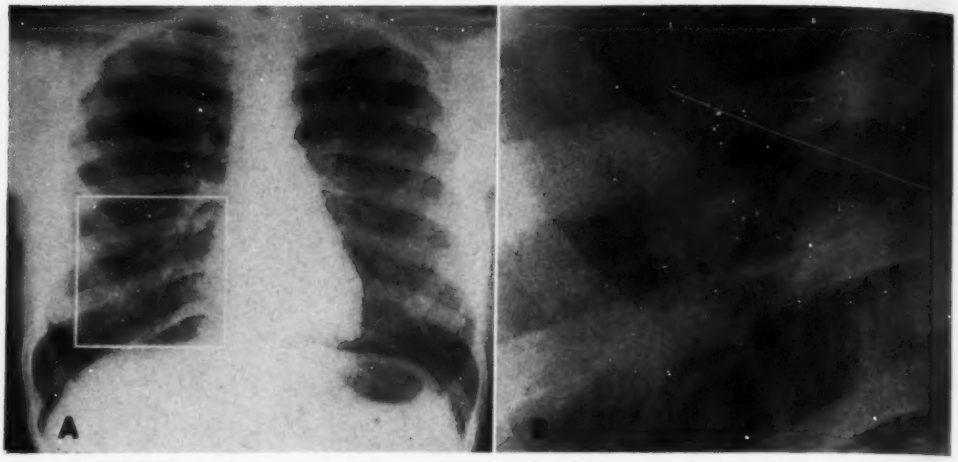

Fig. 4. A. Roentgenogram of a patient with acute respiratory infection.
B. Area from right mid lung field of the roentgenogram reproduced in A. In the center of this picture, the "visible bronchial tree" brings into relief the faint haziness.

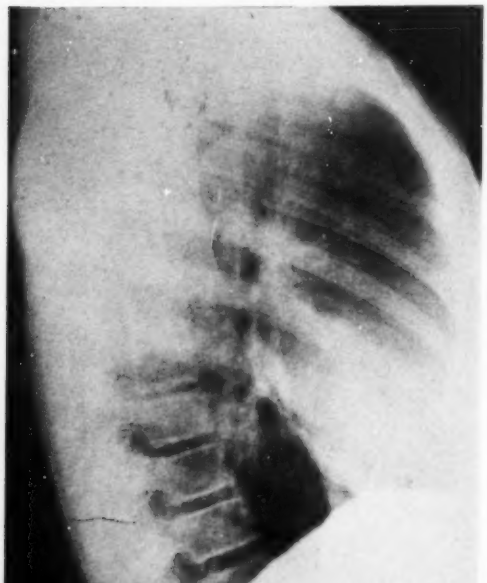

Fig. 4. C. Lateral view of the patient shown in Fig. 4, A and B, to show the small bronchopneumonic consolidation superimposed upon the posterior mediastinum.

of them betray the nature of their filling mass by small air bubbles included in the paraffin. Fig. 2,B, representing the second roentgenogram made of the water-filled box, shows that the air-containing straws stand out as radiolucent bands in the obscured field, while the paraffin-filled straws are invisible.

Usually the phenomenon of the "visible bronchial tree" is easily recognized. However, as with all diagnostic signs not recorded by an automatic device, errors in recording may be made. For example, in some individuals there is a parallel arrangement of the larger vascular shadows in the medial portions of the lower lung fields. These bands are interspersed with narrow stripes of normally aerated lung. Thus a pattern is produced similar to the "visible bronchial tree" in a consolidated lobe. A similar pattern can sometimes be seen in the region of the upper poles of the hilar shadows, particularly on the left. By careful analysis of the dark and light bands, however, and with some experience, most errors will be avoided. Correctly recognized, the sign is infallible and diagnostic. Its presence indicates partial or complete loss of air in the portion of pulmonary parenchyma surrounding the visible bronchus.

The pattern of the visible bronchial tree may be compared with a photographic negative of the normal roentgenogram of the lung. The normal chest film may be described, in simple language, as white

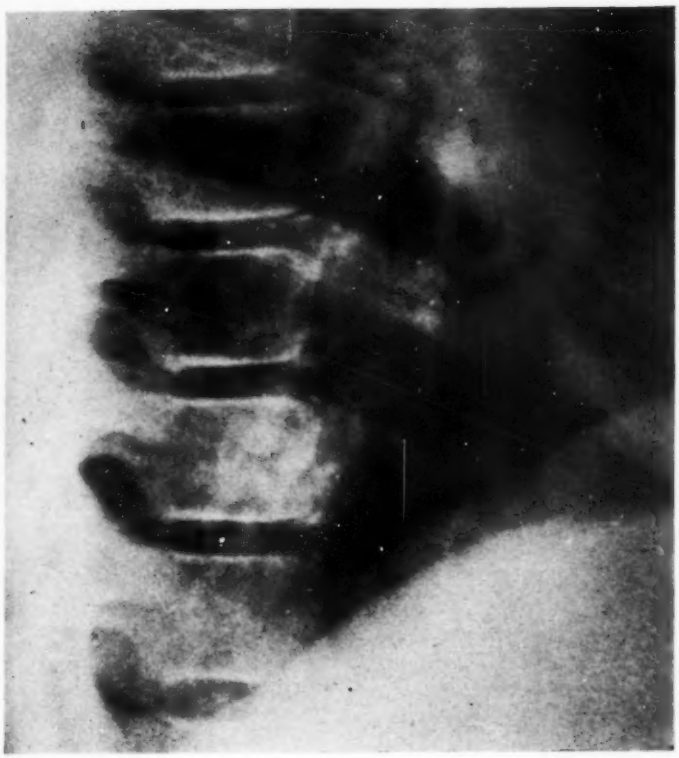

Fig. 5. Lateral view of a patient with localized pneumonic consolidation in the posterior basal portion of the right lower lobe. The "visible bronchial tree" aids the recognition of the consolidation superimposed upon the lower vertebrae.

lines (the vascular shadows) in a black field. The visible bronchial tree, in the case of a pneumonia, is represented by "black" lines in a "white" field, like the air-containing straws in water. Of course, it is understood that the term "photographic negative" is solely descriptive and anatomically incorrect, since in the case of the normal lung the ramifying lines represent the blood vessels, while the radiolucent arborization within the pneumonic field is due to the bronchial tree.

A few examples may illustrate the diagnostic usefulness of this sign. Increased densities in the lower lung fields are often difficult to interpret. These may represent pulmonary consolidation (pneumonia, infarct, etc.) or pleural effusion. Without fluoroscopy or additional radiographic maneuvers, their nature often cannot be determined. Moreover, physical signs are often not reliable, particularly in children. The presence of a "visible bronchial tree" removes every doubt that there is pulmonary consolidation.

This sign has been found useful with pneumonias in the left lower lobe, where the consolidation is hidden by the heart shadow. For example, a normal film taken before the patient became ill with pneumonia of the left lower lobe (Fig. 3, A) shows the normal lung markings through the heart shadow, that is, white lines in a black field. On the film taken during the course of the patient's illness (Fig. 3, B), the black bronchial lumina in the white field signalize the pneumonic consolidation behind the heart.

In other cases it may be difficult to observe a faint haziness at all, or to attribute it with certainty to a pathological process in the lung. In the case illustrated

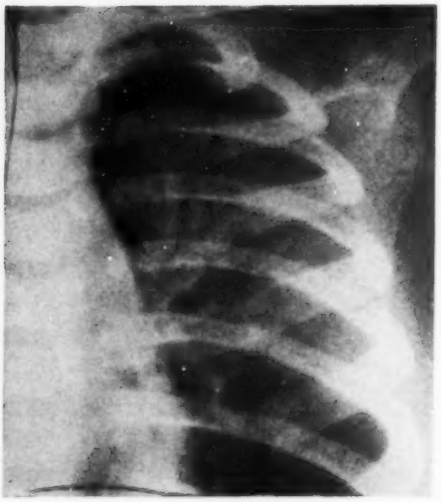

Fig. 6. The "visible bronchial tree" is helpful in recognizing an area of faint haziness in the left mid lung field of an infant, and in relating the shadow to a pneumonic consolidation.

in Fig. 4, A and B, the sharp contrast of the visible bronchial tree in an area of faint haziness in the right mid lung field focused attention on this haziness. Fluoroscopy and a lateral roentgenogram confirmed the presence of a small bronchopneumonic consolidation there (Fig. 4, C). In addition to making it recognizable as haziness, the presence of the visible bronchi allowed its interpretation as pulmonary consolidation.

In another instance, the pattern of the visible bronchial tree brought in relief a pneumonic consolidation in the lateral view, where increased density might easily have been overlooked owing to its being superimposed on the vertebrae (Fig. 5). In the postero-anterior view it was largely hidden behind the dome of the diaphragm.

In infants and children, we found the visible bronchial tree a particularly valuable sign in recognition and identification of consolidations which so often are hard to recognize due to the otherwise overaerated lung, and are not easily identified by physical examination (Fig. 6).

While pulmonary consolidations of any etiology may present identical patterns of the visible bronchial tree—the radiolucent bands in bronchiectasis being wider than the normal ones—there are quite frequent instances where the crowding together of visible bronchi reveals an atelectatic collapse of a lobe or lobar segment (Fig. 7).

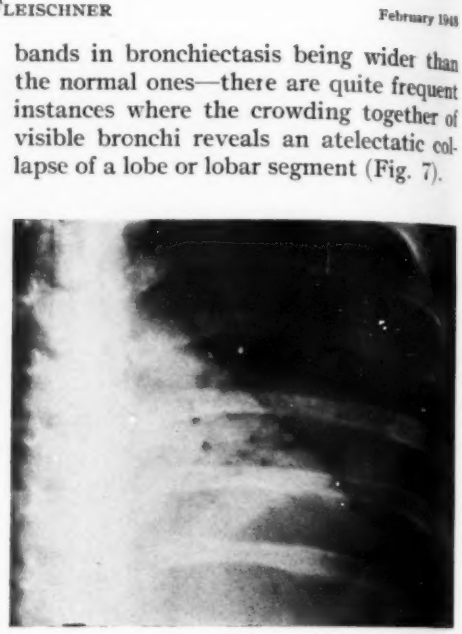

Fig. 7. The visible bronchi crowded together in an atelectatic, collapsed lower lobe, in a case of subphrenic abscess with elevation and respiratory immobilization of the diaphragm. (Observation and roentgenogram by Dr. Leo G. Rigler.)

SUMMARY

The visibility of the air-filled bronchi within parenchymatous consolidations of the lung is explained on theoretical grounds and illustrated by the use of a model. The "visible bronchial tree" is a helpful sign in the recognition of parenchymatous lesions of the lung, especially all types of pneumonic consolidation, including tuberculous pneumonia. Infarcts and tumors may also show this sign if the bronchi are not blocked or filled by blood or secretion. In atelectasis of both the compression and obstructive type, the approximation of the visible bronchi may reveal the atelectatic nature of the pulmonary consolidation. The "visible bronchial tree" is helpful in differentiating basal pneumonic consolidations from pleural effusion or thickened pleura.

Only the presence of the visible bronchial tree is of diagnostic value; its absence does not rule out pneumonic consolidation. Failure to demonstrate the bronchi may be due to filling with secretion, edema, or

blood, or may be the result of technical factors, such as over- or under-exposure, so that the details are not clearly brought out. The sign is particularly helpful in recognizing faint congestion and in relating faint shadows to pulmonary consolidations. This sign has been found most valuable in pediatric roentgenology.

NOTE: I wish to express my thanks to Dr. Herman Zeifer for his help in the performance of our experiment.

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SUMARIO

El Arbol Bronquial Visible: Signo Radiológico en las Hepatizaciones Neumónicas y Otras de los Pulmones

En presencia de una hepatización parenquimatosa neumónica, los bronquios, llenos de aire, pueden volverse tan visibles como un conjunto ramificante de hebras radiolucientes en un campo oscuro. Explícase aquí teóricamente este fenómeno, ilustrándolo por medio de un modelo. El "árbol bronquial visible" constituye un signo útil para el reconocimiento de las lesiones del parénquima pulmonar, y en particular todas las formas de hepatización neumónica, incluso tuberculosa. Los infartos y los tumores también pueden revelar este signo, si los bronquios no se hallan ocluídos o llenos de sangre o secreciones. En la atelectasia de los tipos tanto de compresión como de obstrucción, la aproximación de los bronquios visibles puede revelar la naturaleza atelectática de la hepatización. El "árbol bronquial visible" también ayuda a diferenciar la hepatización neumónica basal del derrame o espesamiento pleural.

Sólo la presencia del árbol bronquial visible posee valor diagnóstico; su ausencia no excluye la hepatización neumónica. La invisibilidad de los bronquios puede deberse a repleción por secreciones, edema o sangre, o proceder de factores relacionados con la técnica, tales como exceso o falta de exposición, de manera que no se perciben claramente los detalles. El signo descrito resulta en particular útil para reconocer una congestión débil y para correlacionar sombras tenues con una hepatización pulmonar. Su utilidad máxima ha sido en la radiología pediátrica.

The Endocrine Factors in Pelvic Tumors, with a Discussion of the Papanicolaou Smear Method for Diagnosis[1]

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THE RELATIONSHIP of hormones to pelvic tumors presents many problems of both academic and clinical interest. These can be briefly enumerated as follows:

(1) Certain types of spontaneously arising neoplasms, both benign and malignant, have been suspected of resulting from hormonal dysfunction, particularly of the sex endocrine system.

(2) Of much importance in this day of extensive hormonal therapy is the role which administered hormones play in inducing neoplasms. That some hormones can be carcinogenic for certain species now seems established quite clearly; that they can favor the growth of certain benign neoplasms already present is also a widely accepted concept, but whether they can produce cancer in the human female generative organs is still controversial.

(3) A factor which has received increasing emphasis is the possible masking of cancer by certain symptoms, such as bleeding, which may be attributed to endocrine therapy which the patient is receiving, thus delaying early diagnosis.

(4) Still a fourth problem concerns the possible use of hormones in the treatment of pelvic neoplasms.

(5) Finally, there is the question as to whether there are any disturbances in the production, metabolism, or excretion of hormones which can be detected by laboratory procedures, which may prove of value in the diagnosis of neoplasms.

THE GONADOTROPHIC HORMONES AND OVARIAN TUMORS

The ovary is stimulated to undergo its normal cyclic anatomic and functional changes by the gonadotrophic hormones of the pituitary; the follicle-stimulating fraction (F. S. H.) concerning itself chiefly with follicular growth and the production of estrogens, and the luteinizing fraction (L. H.) governing the development of the corpus luteum, with the formation of progesterone and additional estrogens (Fig. 1). It is not surprising, therefore, that certain dysfunctional and non-neoplastic enlargements of the ovary may arise from excessive or abnormal gonadotrophic stimulation. These may occur following even mild stimulation, if, because of damage by inflammatory or degenerative lesions, the ovary is incapable of normal response. Such enlargements frequently assume the form of small cystic degenerations of the ovary or even the production of large follicular or corpus luteum cysts. Similar lesions can be induced readily in animals with various gonadotrophic hormones and have been produced experimentally in human beings also (1). It is not at all uncommon to find such enlargements arising during the course of endocrine therapy with gonadotrophins, particularly if these are injudiciously employed. It is remarkable, however, that during pregnancy the ovary usually remains relatively unaffected by the enormous concentration of gonadotrophins of placental origin, although on occasion follicular or luteal cysts may occur during gestation, especially in association with chorionepitheliomas and hydatidiform moles. A number of theories have been advanced to explain these curious facts but are too controversial for discussion here.

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[1] Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–6, 1946.

[2] Associate in Gynecology and Obstetrics, Jefferson Medical College; Endocrinologist to the Jefferson Hospital Laboratories, Philadelphia, Penna.

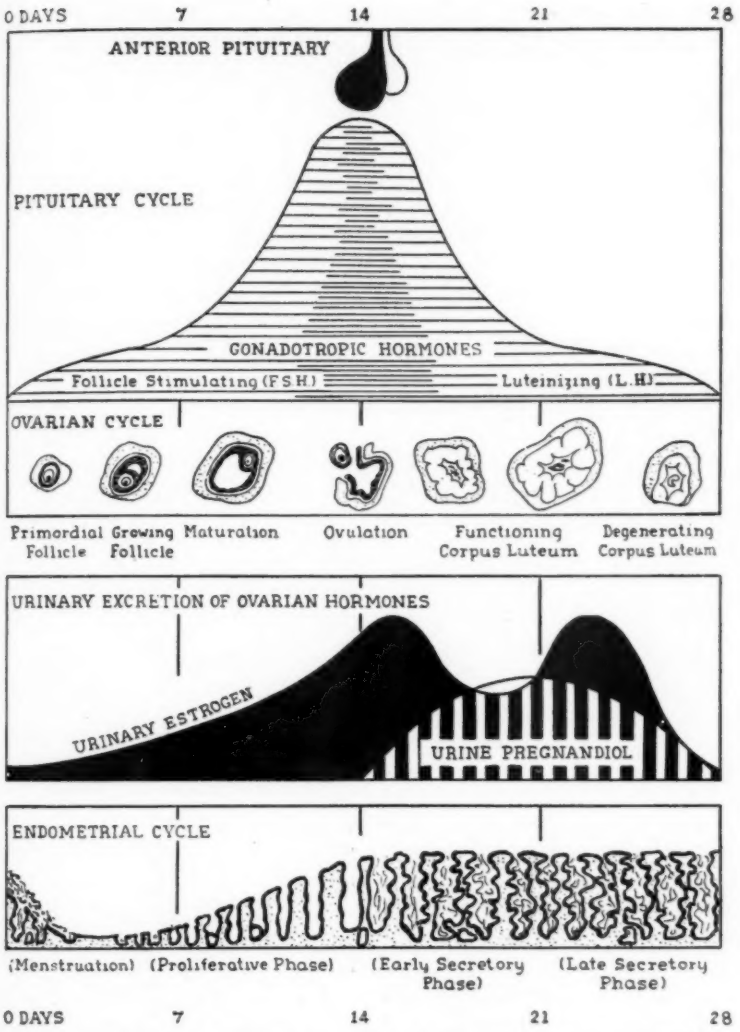

Fig. 1. The female sex endocrine cycle. (From Cantarow and Trumper: Clinical Biochemistry. Philadelphia, W. B. Saunders Co., 3d ed., 1945.)

ENDOCRINE TUMORS OF THE OVARY

Of particular endocrine interest are the rare functioning or "endocrine" tumors of the ovary. Some of these, as the granulosa-cell tumors, thecomas, and some luteomas, produce "feminizing" syndromes because of increased estrogen production, while others, such as the arrhenoblastomas, adrenal tumors of the ovary, and certain luteomas, produce "masculinizing" effects because of increased production of androgenic hormones. These tumors may be either benign or malignant. Although their histogenesis is related to certain embryologic factors in the development of the gonad, no endocrine factor is definitely known to be responsible for their appearance. The possibility of an endocrine influence is suggested by several experiments in which there developed in rat ovaries transplanted to the spleen what appeared to be granulosa-cell tumors

(2). These tumors have been attributed to excessive unopposed gonadotrophic stimulation which is thought to develop in these animals, since the estrogen which normally holds the gonadotrophins in check is removed by the liver before it can enter the systemic circulation. There is no good evidence to indicate that excessive gonadotrophic stimulation is related to the causation of such tumors in human beings. The granulosa- and theca-cell tumors have awakened recent interest in the problem of carcinogenesis also because in post-menopausal women they are sometimes accompanied by endometrial cancer, suggesting that the increased estrogens which they produce may be of etiologic significance in the associated lesion. Indeed, in one study endometrial cancer has been reported in about 10 per cent of patients with granulosa-cell tumors and in about 20 per cent of those with theca-cell tumors, after the menopause (3).

THE OVARIAN HORMONES AND UTERINE TUMORS

As the ovarian follicle develops under gonadotrophic stimulation, the follicular epithelium, granulosa cells, and theca cells produce increasing amounts of estrogens. During the last half of the cycle, estrogens are made by the corpus luteum, which also makes its own specific hormone, progesterone (Fig. 1).

In addition to exerting many other important physiologic functions, estrogens stimulate the growth of the mucosa of the entire genital tract and the duct system of the breast and have, therefore, from their very discovery, been regarded as of possible etiologic significance in tumors arising in these structures. From the theoretical standpoint, this supposition was enhanced by the close chemical relationship of the estrogens to certain steroid carcinogens, as benzanthracene and methylcholanthrene. This belief has been furthered, also, by the experimental production of cancers in certain species by means of estrogen administration.

Progesterone, the second ovarian hormone, is normally concerned with the production of secretory changes in the endometrium in anticipation of pregnancy, inhibiting excessive uterine contractions, and developing the alveolar system of the breast. Although closely related chemically to the estrogens, it has not been implicated by experimental evidence as a carcinogenic agent.

Estrogens and Cancer of the Endometrium: Although glandular hyperplasia of the endometrium can be readily produced in many species of animals, indeed even to the point of pyometra in some, as in mice and rats, benign and malignant epithelial tumors of the uterine body very rarely appear after administration of estrogens. On the other hand, there have been certain observations which have suggested that endometrial hyperplasia in the human being may be a precancerous lesion (4). The evidence may be summarized as follows:

(1) Endometrial hyperplasia has been experimentally produced in many species, including the monkey, especially when unopposed by progesterone. In women, it frequently occurs spontaneously at the menopause, when the balancing effect of the corpus luteum is gone, or in younger women with ovarian dysfunctions, probably for similar reasons.

(2) The histologic changes vary from a proliferation of the endometrium to those simulating early adenocarcinoma.

(3) Islands of squamous epithelium are well known to occur in the human endometrium and are perhaps the counterpart of the squamous metaplasia developing in animals following administration of estrogens. Such metaplasia is sometimes found as an associated lesion in endometrial hyperplasia.

(4) Pathologic specimens in which carcinoma is found arising in a hyperplastic endometrium are not uncommon, according to certain observers; others insist that the association is no more than accidental.

(5) Increasing numbers of cases are reported with an association of a granulosa-cell tumor of the ovary and adeno-

carcinoma of the endometrium, suggesting the sequence of hyperestrogenism, hyperplasia of the senile endometrium and, finally, adenocarcinoma.

(6) On the other hand, it has been pointed out that while endometrial hyperplasia is a common condition, endometrial carcinoma is relatively rare, and in long-term observations of many cases with hyperplasia, fundal cancer develops in but a few. The available data seem to indicate that endometrial hyperplasia is not ordinarily of itself a precancerous lesion; yet there is some reason to believe that under certain circumstances it may become one. Whether these circumstances relate to genetic factors, hormonal imbalance or other influences, remains to be learned.

Estrogens and Cancer of the Cervix: Experimental cancers of the cervix have been readily produced by injections of estrogens in only one species, namely the mouse (5). In these experiments, now amply confirmed, it was significant that the "strain" factor and the "milk" factor so important in inducing breast cancers were not essential for the production of cervical cancers. It is also of interest that the simultaneous administration of androgens or progesterone did not alter the cancer incidence. In monkeys (6) squamous metaplasia has been observed following estrogen injections, but true instances of uterine or mammary cancer have not been produced even when the treatment was continued for six years or more. It has been pointed out (4), however, that monkeys have no innate tendency to acquire such neoplasms so far as can be judged from the available records.

There are a number of clinical observations which have been thought to suggest an endocrine factor in the development of cervical cancer. This lesion is known to occur more frequently in multiparous women than in those who have not borne children. On this basis it long has been thought that birth injuries predispose to the development of cervical cancer. Hofbauer (7), however, advanced the theory that the increased incidence of cancer of the cervix in this group may result rather from intensive stimulation by the rising titer of estrogens during pregnancy. Indeed, during pregnancy the histologic appearance of marked hyperplasia of the cervical epithelium sometimes presents features difficult to distinguish from so called "cancer *in situ*."

Cancer of the cervix has been reported only rarely in association with granulosa-cell tumors,[3] nor does it show any predilection to occur with other lesions indicative of hyperestrogenism. On critical analysis, observations on the excretion of hormones have not shown any significant abnormalities in cancer patients, with the possible exception of the work of Pincus and Graubard (9), who report a change in the ratio of the estrone to estriol fraction, possibly indicating some abnormality in the metabolism of the estrogens in the presence of cancer.

In a number of instances, metaplasia of the cervical epithelium has been observed, following estrogen administration in women. Usually these lesions regressed following withdrawal of treatment, but Nathanson (10) noted one case in which an early cancer was found. Cervical polyps have also been attributed in some cases to estrogen therapy. Similarly, several instances of cancer developing in patients under treatment for senile vaginitis have been reported. These statistics are as yet most difficult to evaluate in view of the huge numbers of menopausal women who have now been receiving estrogen therapy for many years. One group of observers (11), for instance, failed to find any of the above mentioned lesions in more than 200 women who had received large doses of estrogens continuously over periods varying from a half to five and a half years The evidence, therefore, is at present equivocal. As so well summarized by Twombly and Pack (12), "while estrogens undoubtedly cause

[3] Two cases of carcinoma of the cervix associated with granulosa-cell tumor of the ovary have been reported by Scheffey (8).

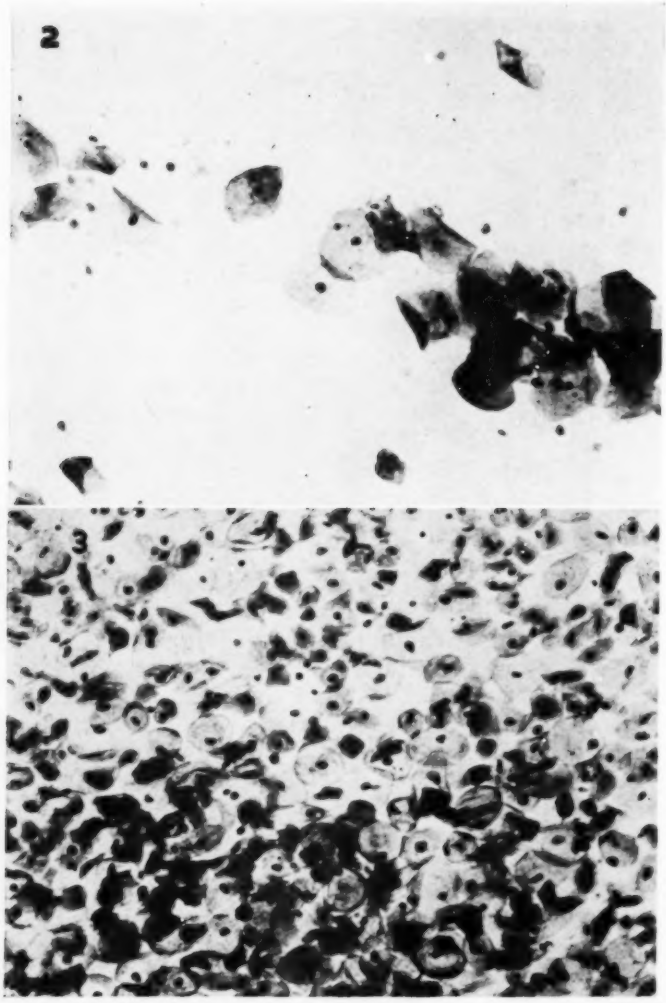

Fig. 2. Vaginal cytology smear from normal woman showing cornified squamous epithelial cells, indicating good estrogenic effect.
Fig. 3. Smear from a menopausal woman showing small round cells from the basal layer of the vagina, indicating an estrogen deficiency.

certain kinds of cancer in mice, the assumption that they do so in man must be labelled 'not proved' for the present."

Fibromyomata: A type of fibromyomatous growth has been shown (13, 14) to occur in the uterine subserosa or myometrium of guinea-pigs given estrogens over a prolonged period. Such tumors, however, also occurred throughout the abdominal cavity and possessed some degree of malignancy in that they occasionally invaded other viscera. These tumors not only regressed when estrogens were withdrawn, but their development could be prevented by the simultaneous administration of progesterone, desoxycorticosterone, or testosterone (15). These growths could be produced with synthetic estrogens as well as with natural estrogens, but only in the guinea-pig. They have not been produced in estrogen-treated animals of other species.

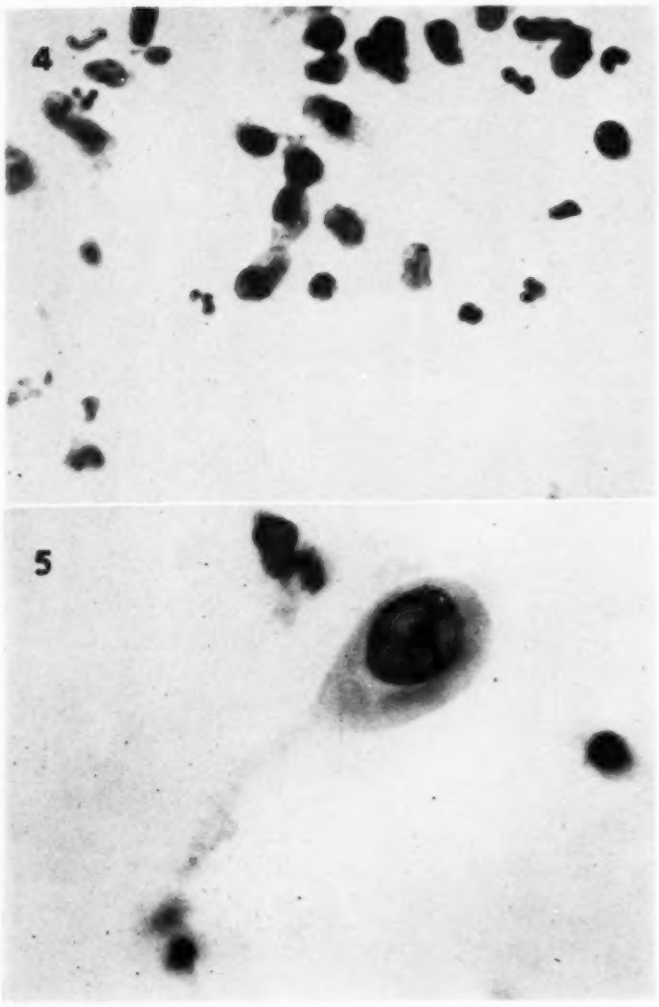

Fig. 4. Vaginal smear showing normal endometrial cells. Note their small size, with relatively large, clear nuclei.
Fig. 5. Typical tadpole cell from a patient with a well differentiated squamous-cell carcinoma of the cervix. Note the bizarre morphology, the huge nucleus, and the prominent nucleolus.

In the human being endocrine dysfunctions, particularly of the ovaries, have long been regarded as a causative factor in the production of fibromyomata. The evidence, however, is far from conclusive. Thus, follicular cysts and endometrial hyperplasia have been said to frequently accompany fibroids, suggesting that hyperestrogenism, or even long continued, unopposed low-grade estrogen stimulation, results in the appearance of fibroids. Despite this, in some carefully studied series of cases, particularly the group of 100 cases reported by Brewer and Jones (16), these associated lesions have not been found in a higher percentage than would be expected in normal women. Moreover, Meyer (17) stresses the point that patients with fibroids become pregnant, menstruate normally, and undergo typical

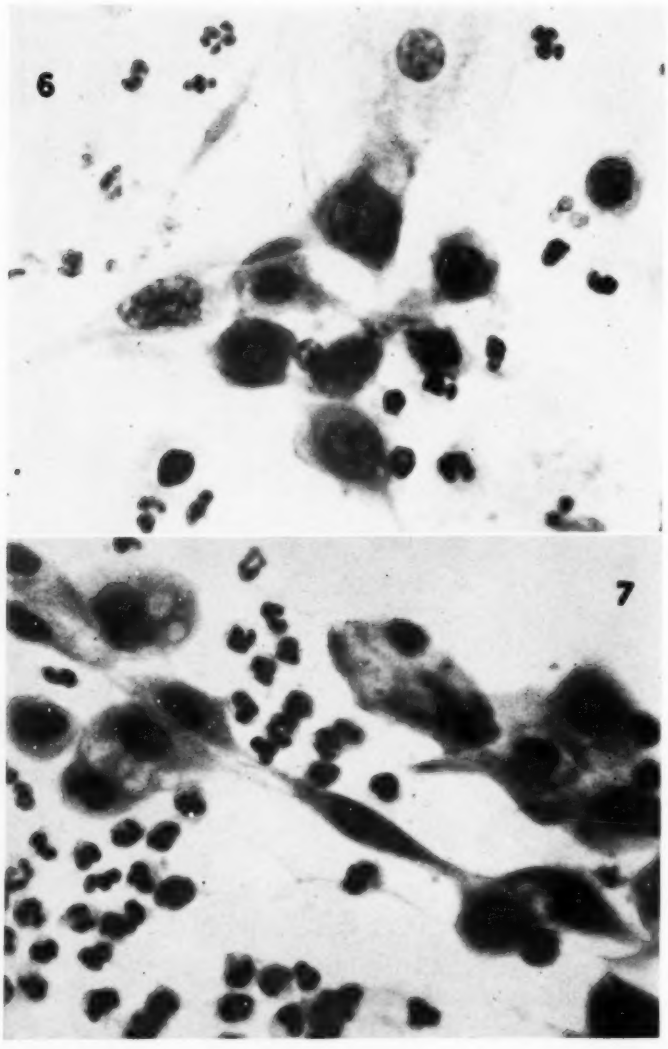

Fig. 6. Smear from a patient with an embryonic form of squamous-cell carcinoma. Note the bizarre prickle-type cells, many of which are multinucleated.

Fig. 7. Smear from a patient with adenocarcinoma of the cervical canal. Note the irregular, round or ovoid cells, with large dense irregular nuclei, present in this smear.

cyclic changes, all of which is against ovarian dysfunction. The excretion of estrogenic and androgenic substances in the urine of women with fibroids has also been found to be within normal limits (18).

Perhaps the most convincing evidence for a hormonal etiology is the regression which is often observed in these tumors in the postmenopausal period, after ovarian activity has ceased, and, conversely, the rapid enlargement of fibroids in patients receiving injudicious estrogen therapy. In some instances the administration of testosterone or progesterone appears to cause a degree of regression in the size of these tumors.

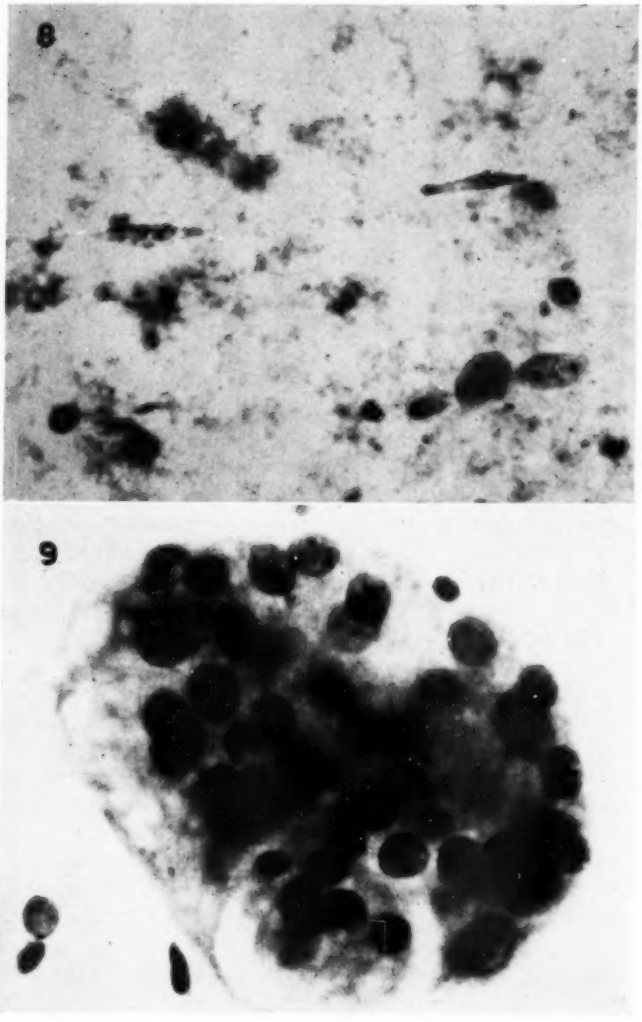

Fig. 8. Smear from a patient with myosarcoma of the uterus. Note the small elongated cells with dense bizarre nuclei.
Fig. 9. Smear from a patient with fundal carcinoma. Note the clump of densely stained endometrial cells of irregular size, many of which are intensely hyperchromatic.

VAGINAL CYTOLOGIC SMEARS FOR THE DIAGNOSIS OF UTERINE CANCER

Cytologic examination of vaginal smears stained by special methods has been used for some years as an indicator of ovarian function. It was in the routine examination of such smears that Papanicolaou observed peculiar cells with cytologic characteristics suggestive of malignancy; further check revealed that these patients actually had cancer of the cervix.

The value of the vaginal cytology smear as a diagnostic aid in uterine cancer has been presented in a number of publications, particularly those of Papanicolaou and Traut (19), Meigs and his co-workers

(20), and Ayre (21). Its more widespread employment is limited by the fact that considerable training and experience are required to become proficient in its use. It is to be emphasized that the method is not intended as a procedure for establishing the diagnosis of cancer of the uterus but rather as a means of finding additional cases which should have the benefit of cervical biopsy and curettage. The method should be used as a supplement to present procedures and not to replace them. It should be borne in mind, also, that in some instances single smears may miss cases with obvious lesions, while in other instances smears suggestive of malignancy may be found in benign lesions. On the other hand, careful investigation of patients with suspicious smears has led to the discovery of very early cases of cancer of uterus which would have otherwise been overlooked.

Evaluation of the Papanicolaou Method on a Routine Gynecologic Service: We are at present engaged in compiling the results of vaginal smear studies made on 500 patients admitted to the Gynecologic Wards of the Jefferson Hospital. These smears were examined cytologically for the presence of cells suggestive of malignant growth. The results of the smears, taken by number only, were compared with the diagnosis after the histologic studies had been completed. At present 418 of these cases have been reviewed. The results are as follows:

Total number of patients	418
Patients with cancer of the uterus	59
Correct positive smears	41 or 70%
False negatives	17 or 28%
Doubtful smear	1 or 2%
Patients who did not have cancer	359
False positives	4 or 1.1%
Doubtful smears	5 or 1.4%

Of the 41 patients with smears positive for cancer, 37 had cervical cancer. Of 4 fundal carcinomas, 2 were diagnosed correctly on vaginal smears and 2 were missed.

Our experience with the vaginal smear method thus far leads us to believe that the procedure is sufficiently worthwhile to be made a routine part of the examination on a gynecologic service. It is apparent, however, that from single examinations a goodly percentage of cancers can be missed. Further investigations have shown us that many of these could be picked up by repeated smears. However, if cancer is not suspected, it is not likely that repeated smears will be taken.

Our experience to date has been that endometrial cancers are much more difficult to pick up by the vaginal smear method than are cervical cancers. This is chiefly due to the fact that the abnormalities in cytology are less marked than they are with cancers of the cervix.

Particular attention is drawn to the false positives and the doubtful smears. In 3 of the 4 false positives, the diagnosis was pelvic inflammatory disease, and in 4 of the 6 doubtful smears, pelvic inflammatory disease was present.

The question has been raised as to whether smears from the cervix may reveal a higher percentage of positives. We are at present engaged in taking one smear from the vagina and one smear from the cervix for comparison. In at least one instance, the vaginal smear gave a correct positive which was missed on the cervical smear. The best procedure, therefore, is probably taking smears from both sites.

Typical smears from normal patients and patients with fundal carcinoma and carcinoma of the cervix are shown in Figures 2 to 9.

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DISCUSSION

J. P. Greenhill, M.D. (Chicago, Ill.): This paper briefly but most satisfactorily takes up two distinct subjects. I agree with almost everything said by Dr. Rakoff, but I should like to amplify different aspects of the problem.

First, as to the role of the endocrine glands in the causation of cancer of the female genitals: the carcinomas which may have an endocrine basis are those of the cervix uteri and corpus uteri. Generally speaking, there are two types of cancer (1) an irritation cancer such as that produced by tar and (2) so-called spontaneous carcinoma for which there is only a constitutional cause and not a local one. Support for the constitutional group is found in Maud Slye's breeding experiments in mice and the study of human twins. Experimentally, changes which resemble carcinoma have been produced in the cervical epithelium by the injection of anterior pituitary hormone and by the implantation of pieces of pituitary gland. Hofbauer showed that the cervical epithelium both in pregnancy and in the nonpregnant state is under the influence of the pituitary gland. In fact, only the epithelium of the female genitals reacts to such hormonal stimulation. Zondek found that anterior pituitary hormone was excreted in the urine of about 80 per cent of women who had genital cancer, whereas this hormone was absent in most of those having extragenital malignant tumors. Likewise, this hormone was found in men who had carcinoma of the testis but not in men who had cancer of the prostate. Hence, cancer of both the male and female genitals creates special hormonal conditions.

Now as regards cancer of the body of the uterus: Dr. Rakoff discussed the theoretic possibility of the production of cancer of the uterus by excessive estrogen stimulation. There does seem to be a connection between hyperplasia of the endometrium and cancer in a few cases. Some proof is afforded by the cases of cancer of the uterus which follow radiation therapy for menopausal bleeding. In women treated by irradiation for menopausal bleeding, cancer of the uterus occurs almost three and a half times as frequently as in women not subjected to radiation therapy. This, of course, does not mean that the radiation therapy is the cause of cancer. What it does imply is that the original condition which caused the bleeding and which was treated by x-ray and radium developed into a cancer. Of great significance is the fact that a large proportion of women who have irregular and profuse bleeding at the menopause have endometrial hyperplasia. Further, there is an abnormal preponderance of cancer of the body of the uterus rather than of the cervix, indicating a possible relationship between the endometrial abnormality which was treated by radiation therapy and cancer.[1]

Dr. Rakoff discussed the relationship of the estrogens to the development of the endocrine tumors of the ovary, namely granulosa-cell tumors and arrhenoblastoma. I, too, do not believe that endocrines cause these tumors. May I emphasize, however, that these neoplasms are not always benign. Usually the recurrences and metastases appear many years after the tumor has been removed.

[1] See Corscaden, Fertig, and Gusberg: Am. J. Obst. & Gynec. **51:** 1–12, January 1946.

As to the relationship of estrogens to the development of uterine fibroids, may I emphasize the experiments of Lipschütz and those of Nelson, who independently produced uterine fibroids in guinea-pigs by prolonged treatment with estrogens. These authors produced fibroids not only in the uterus but also in the mesentery, spleen, pancreas, and abdominal wall. Continuous action is an essential factor of tumor genesis. This is a most important fact, overlooked by many physicians. The practical application of this knowledge is that *no* estrogen should ever be given continuously, regardless of the indication for its use. Many women in and after the menopause have irregular bleeding as the direct result of the continuous use of estrogens. The safest way to prescribe an estrogen for menopausal or other symptoms is to have the patient take the estrogen for twenty nights, stop ten nights, and repeat. Parenthetically, may I add that estrogens should never be prescribed for women who have had cancer of the breast.

As regards the vaginal smear for the detection of early cancer of the uterus, I agree wholeheartedly with Dr. Rakoff that the procedure is a great advance. Likewise, I concur that smears should be made from the cervix as well as from the vagina. If all women will have smears made at the time of a routine check-up, we shall find many early cancers which can easily be treated by simple amputation of the cervix. We shall not only avoid the necessity for serious operations and extensive radiation therapy, but also we shall save many lives which would otherwise be lost.

A. E. Rakoff, M.D. (*closing*): I want to thank Dr. Greenhill for his able discussion and the points which he has raised. One point in particular in which I was interested was the question of the use of radiation therapy in patients with endometrial hyperplasia, with later recurrence of bleeding found to be due to fundal cancer. I wonder if the same danger does not exist in radiotherapy of patients with possible cancer as in endocrine therapy. One of the great things which we have to fight in endocrine therapy at present is the masking of cancer by the use of hormones. So many women who receive hormones and then begin to have uterine bleeding are told not to worry, since the bleeding is undoubtedly due to the estrogen which was administered. In a certain number, it later turns out to have been due to cancer. In other words, if hormones are given and the patient bleeds, there is nothing left to do but to investigate and make sure, by curettage or by biopsy, that no cancer is present. The same situation may occur during the course of radiotherapy for bleeding. In other words, masking the symptoms may also mask an underlying tumor.

Many of you may be interested in learning that the Papanicolaou smear method is now being used in our clinic in patients who are receiving x-ray and radium therapy, and is proving very useful. As radiation therapy proceeds, there is a definite improvement in the smear, though it is amazing how long it remains "positive" following treatment. Some of the cells which are found in patients who have had radiotherapy are entirely different. They are much more bizarre than those found in untreated cancers.

In cancer clinics throughout the city of Philadelphia, the routine examination of every woman includes Papanicolaou smears, one from the vagina and one from the cervix. It is still too early to report the results in this group. I can only say that by the use of the smear in our routine work, we have picked up at least two cases of cancer which were wholly unsuspected on gynecologic examination.

SUMARIO

Los Factores Endocrinos en los Tumores Pelvianos con una Discusión del Método de Frotes de Papanicolaou para Diagnóstico

Repásanse los datos en pro y en contra del papel de los factores endocrinos en la oncogenia pelviana.

Aunque los experimentos en animales indican tal posibilidad, no se conoce positivamente ningún factor endocrino como causante de neoplasias ováricas del género de los tumores de las células de la granulosa y la teca folicular.

Mediante la administración de estrógenos puede producirse en los animales hiperplasia glandular del endometrio y ésta puede también sobrevenir espontáneamente en las mujeres una vez desaparecido el efecto equilibrador del cuerpo amarillo, como sucede en la menopausia o cuando existe disfunción ovárica. Los datos disponibles indican que dicha hiperplasia no es ordinariamente precancerosa, pero que puede pasar a serlo.

En los animales se provoca sin dificultad cáncer cervical con la inyección de estrógenos, y varias observaciones clínicas denotan la intervención de un factor endocrino en su desarrollo; por ej., la mayor incidencia en las multíparas y la aparición ocasional de cáncer en enfermas que reciben estrogenoterapia durante un período prolongado.

La disendocrinia, en particular ovárica, ha sido considerada de viejo como factor causante en la producción de fibromiomas. La prueba más convincente de dicha relación se halla en la frecuente regresión de esos tumores al cesar la función ovárica en la menopausia y en su rápido agrandamiento tras una estrogenoterapia irreflexiva.

Como complemento de los procedimientos actuales para el diagnóstico del cáncer cervical reconiéndase el empleo sistemático del método de los frotes vaginales de Papanicolau. De 418 enfermas en que se utilizó esa técnica, en 59 se descubrió después cáncer. Los frotes resultaron positivos en 41 (70 por ciento) de las 59; 17 fueron seudonegativos, y uno solo fué dudoso. Entre las 359 mujeres sin cáncer, 4 frotes fueron seudopositivos y 5 dudosos. Pueden necesitarse frotes repetidos para descubrir la presencia de cáncer.

Myelography in Intervertebral Disk Protrusion

Horizontal Beam Examination with the Patient Prone[1]

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THE ADVANTAGES of contrast myelography in the diagnosis of protruded intervertebral disk are considered by many neurosurgeons to be too slight to offset the possible (though unproved) risks of introducing lipiodol into the subarachnoid space, and they have preferred to base their indications for operation on careful evaluation of the clinical findings. Whether or not this attitude is justifiable, it is at least a signal for the radiologist to review his results more critically. Upon doing so, he cannot but confess that x-ray diagnosis of disk protrusion as generally practised has certain shortcomings which detract from its efficiency.

Several investigators have sought to determine the cause of these shortcomings. Among the factors mentioned, the most important would seem to be the narrowness of the dural sac and lateral protrusion of the disk. That these do not account for all failures of the protruded disk to produce a characteristic defect in the oil column is, however, clear to anyone who has seen many of these cases in the operating room. With these considerations in mind, we sought to determine whether the dural sac is always in direct contact with the posterior surface of the vertebral bodies and the intervertebral disks, as has been commonly assumed. We found that, especially in the region of the fifth lumbar vertebra, where most protrusions occur, this is frequently not the case.

For our investigation, the patient was placed in the prone position and examined with the horizontal x-ray beam and vertical film or screen (Fig. 1). In this position the best possible filling of the sac in the region under consideration is obtained, and at the same time opportunity is afforded to glance between the sac and the posterior surface of the vertebrae.

It was found that the sac is, indeed, usually in direct contact with the body of the vertebra, but that in a certain percentage of cases (about 15 per cent) they are separated by a space averaging 2 to 4 mm. in width (Fig. 2), and in extreme instances (5 to 8 per cent) reaching as much as 10 mm. This space, the so-called epidural space, attains its maximum width between the fifth lumbar and the first sacral vertebrae. At this site the majority of spines show a sudden lordotic curve, and this angulation may give rise to an abnormal relation between sac and vertebra, as will be explained. So long as the length of the dural sac is ample, it can follow the ventral side of the canal, although this is the longer path, and it will do so because the nerve roots pull it ventrally. In cases of marked widening of the space, however, the dural sac appears to be stretched like a hammock between its attachment to the dorsal side of the sacral canal and its cranial attachment, following the dorsal rather than the ventral margin of the canal (Fig. 3). The significance of this observation is obvious. An intervertebral hernia protruding from the ventral side into the spinal canal will not reach the dural sac unless its size is very considerable. And so long as the protrusion does not reach the dural sac, one cannot expect to observe its presence as a defect in the lipiodol column. It is quite possible, however, that it may cause a compression of one of the nerve roots, as these have to cross the site where protrusions occur just as in cases in which the dural sac is of ample length. With this knowledge, we were able in several instances to declare the presence of a pro-

[1] Accepted for publication in October 1946.

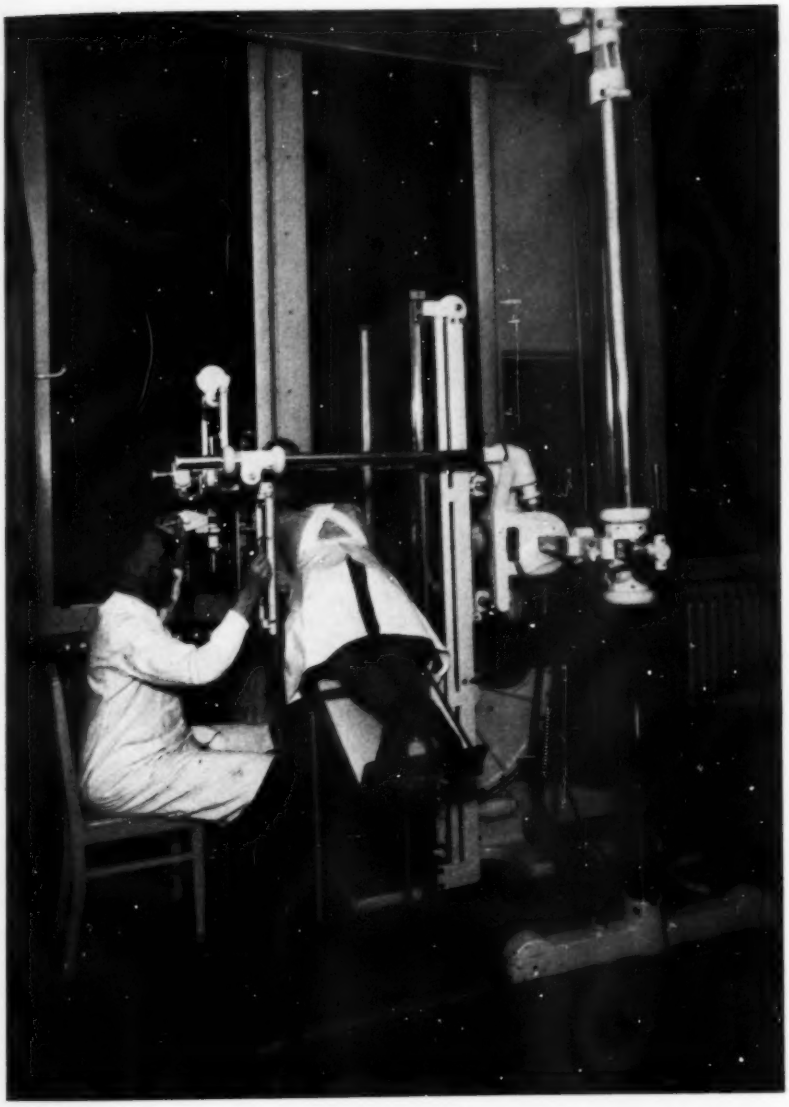
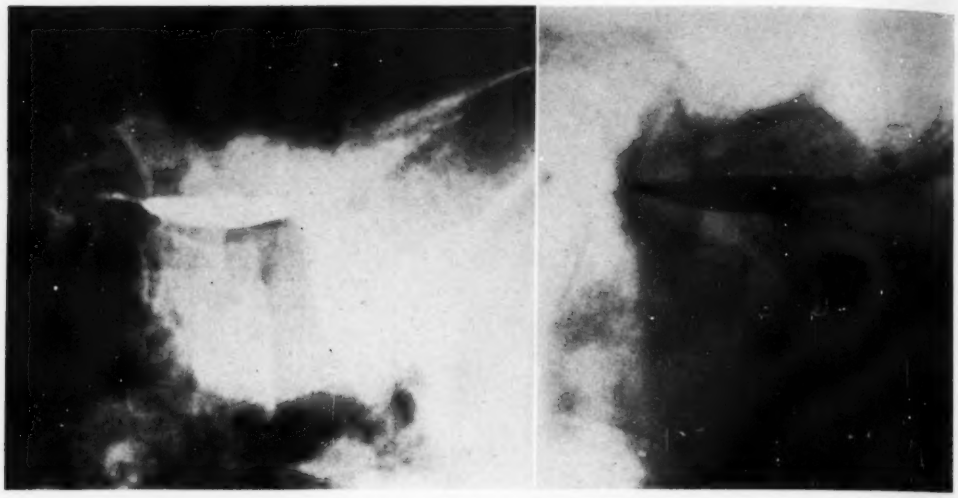


Fig. 1. Position of patient for examination with horizontal x-ray beam and vertical film or screen.

trusion possible, even in the absence of a defect in the lipiodol column, with the result that the patients were successfully treated.

The examination is made on a special narrow tilting table placed between the table and screen of the vertical fluoroscope (Fig. 4). With the patient prone, the x-ray beam traverses the body horizontally. With good adaptation, high kilovoltage at the tube, the maximum possible milliamperage, a narrow x-ray beam, and a fine Bucky grid, it is possible to observe fluoroscopically the relation of the medium in the sac to the vertebrae. Spot films can be taken for further confirmation. The tilting of the patient takes place around a horizontal axis



Figs. 2 and 3. Widening of the epidural space. This space attains its maximum width between the fifth lumbar and first sacral vertebrae.

that traverses the body approximately at the fifth lumbar. In the presence of a protrusion, one sees the lipiodol accumulate before the protruded disk on tilting, and on reaching the top, flow over it, sometimes in drops and at other times in a steady fall (Fig. 5). Or there may be merely a dent in the deposit (Fig. 6).

Not only does this procedure eliminate the possibility of a false negative diagnosis, but it gives an insight into certain affections of the vertebral bodies that may prove enlightening. As is well known, the posterior surface of the vertebral body may be somewhat concave. In such a case the posterior borders near the intervertebral disk protrude a little dorsally, together with the disk itself. Considering a number of vertebrae, the ventral margin of the spinal canal is somewhat undulating, with a ripple of (up to) 5 mm. Lipiodol, flowing over the undulating surface (in case the dural sac closely follows the ventral margins), has to pass over thresholds that can interfere with the normal flow and even cause breaking up of the column. Figure 7 shows how the flow narrows at L4-L5, while Figure 8 shows that unquestionably no protrusion is present at that disk, but that a non-pathological threshold is the

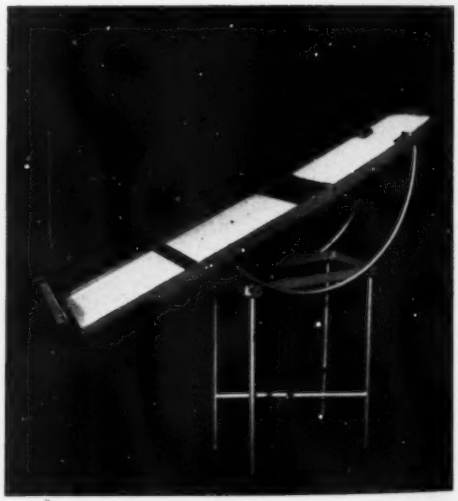


Fig. 4. Tilt table for horizontal-beam examination.

cause of the narrowing. Occasionally this may be responsible for actual breaking up of the column, which may occur after a short period of waiting, as every radiologist knows.

In some instances the indentation in the dural sac is caused partly by a true disk protrusion and partly by bony exophytes on the posterior margins of the vertebral bodies, *i.e.*, spondylotic ex-

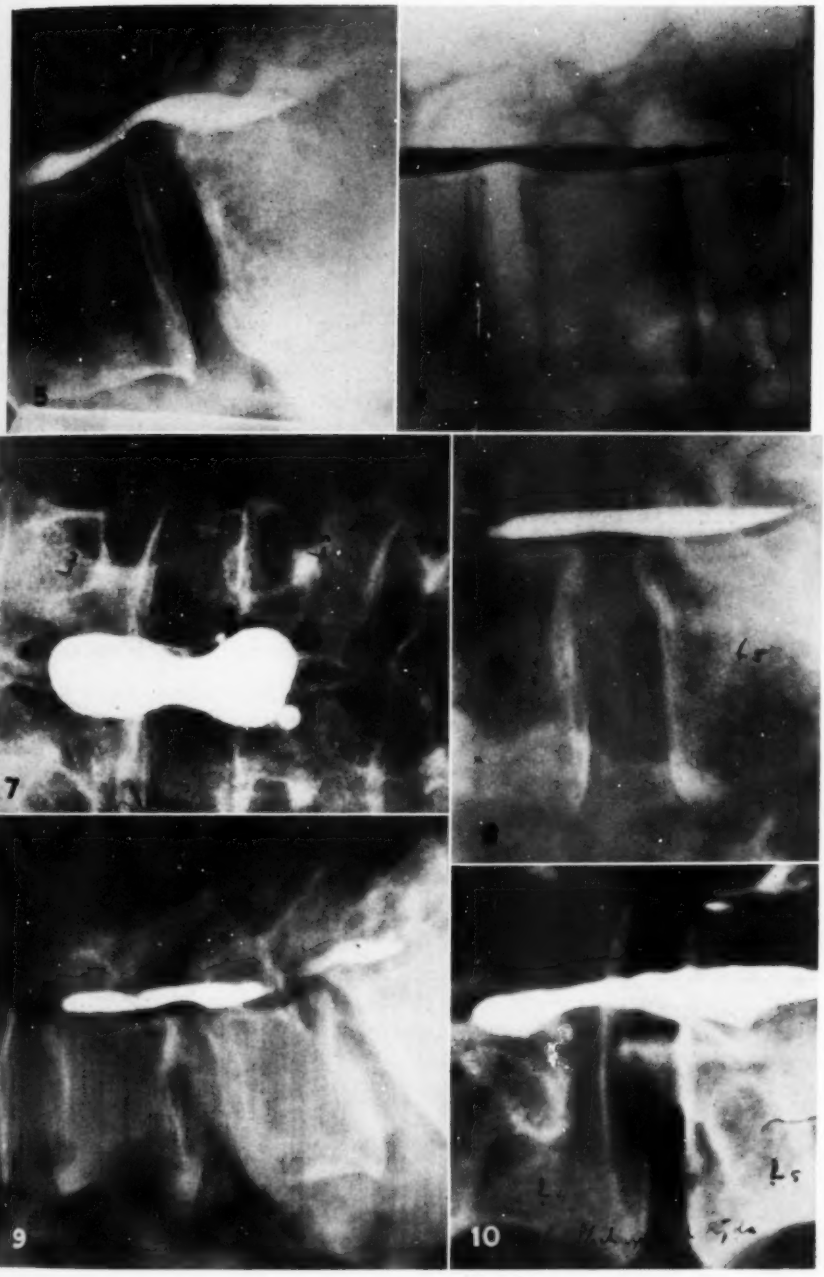


Fig. 5. Steady fall of lipiodol over the protruded disk.
Fig. 6. Indentation in lipiodol column due to disk protrusion.
Fig. 7. Narrowing of lipiodol column at L4-L5.
Fig. 8. Narrowing of lipiodol column in the absence of disk protrusion.
Fig. 9. Disk protrusion with associated spondylotic changes.
Fig. 10. Large disk protrusion over which the nerve root runs in an arc.

crescences (Fig. 9). Another reason for examination of a patient with the horizontal beam, as we might call it, is that in the presence of a very narrow sac, a laterally situated protrusion, and nerve root sheaths filled with lipiodol, one may sometimes see the nerve root running in an arc over the protrusion (Fig. 10).

If part of the lipiodol is deposited in the epidural space as a result of faulty injection, this epidural deposit, if it reaches the level of the fifth lumbar vertebra, may give rise to difficulties of interpretation. Though the experienced observer may be able to distinguish between the freely flowing intradural and the slowly moving epidural lipiodol, the diagnosis is certainly rendered more difficult and the extra information furnished by the horizontal-beam examination becomes even more useful. The epidural lipiodol accumulates chiefly at the dorsal side of the spinal canal. This is the lowest level when the patient is lying on his back. When the patient is placed in the prone position, this epidural lipiodol does not move quickly to the ventral side, as the intradural deposit does, and one can distinguish easily between the two, at the same time using the ventral (intradural) deposit for diagnosis. In some cases one becomes aware of the presence of epidural lipiodol only in this way.

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SUMARIO

La Mielografía en las Proyecciones de los Discos Intervertebrales

En el examen con lipiodol del conducto vertebral, conforme a la técnica del A., colócase al enfermo en decúbito prono, se asesta horizontalmente el haz de rayos X y la película o pantalla se halla en posición vertical. Observóse así que el saco dural, aunque por lo general en contacto directo con el cuerpo de la vértebra, puede quedar separado del mismo por un espacio de ancho variable (el llamado espacio epidural), sobre todo en la región de la quinta vértebra lumbar. Si la anchura es grande, el saco dural parece hallarse estirado como una hamaca, entre su inserción en la cara dorsal de la porción sacra del conducto y su inserción craneal, siguiendo el borde dorsal más bien que el ventral del conducto, de modo que un disco que proyecte intrarraquídeamente tal vez no llegue al saco y provoque una desviación característica en la columna de lipiodol. En cambio, puede provocar una compresión de las raíces de los nervios en el sitio de la proyección, indicando así el diagnóstico.

Expónense las ventajas que posee la técnica del haz horizontal, con grabados que revelan las alteraciones de la columna de lipiodol, tanto cuando existe como cuando no existe proyección del disco.

A Subsequent Report on Roentgen Therapy in the Carotid Sinus Syndrome[1]

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IN FEBRUARY 1939, one of us (C. A. S.) reported in this journal (1) on the use of roentgen therapy in five cases of the carotid syndrome. One of the patients (Case 4) was followed for only one year, during which time she had had no attacks. After this, we were unable to trace her. The other four patients have been followed up to December 1946; three have had no attacks since receiving roentgen therapy in 1938, while the other patient has had only mild attacks and at much longer intervals than formerly. Nineteen additional cases have now been treated, making a total series of twenty-four.

Since this paper represents a follow-up study, no effort will be made to discuss the diagnosis of the carotid sinus syndrome. The original article should be reviewed, as well as the general medical literature on the subject, so that the radiologist may become familiar with this symptom complex before attempting to treat it.

The carotid sinus syndrome may present a variety of symptoms and findings but, because of the efferent pathways from the carotid sinus, the syndrome is usually one of three types: in the first type the reflex arc is to the medulla and then, *via* the thalamic region, to the cerebral cortex. When this is the area over which the impulses travel, the main symptom is syncope. In the second type, the reflex arc is apparently from the sinus *via* the sinus nerve and its connection with the vagus nerve. When the reflex arc is over this pathway, the outstanding finding is cardiac slowing or even asystole. In the third type, the reflex arc is from the sinus, *via* the sinus nerve and its connection with the glossopharyngeal nerve, to the superior cervical sympathetic ganglia. When this arc is followed, there is a fall in blood pressure without cardiac slowing.

All of this group of twenty-four patients showed a duplication of their attacks when pressure was applied over one or both carotid sinuses. When the patient returned to the clinic, he was again seen by the same physician, who attempted to reproduce the carotid sinus attacks. Many patients had electrocardiograms made at the time of carotid sinus pressure.

No specific drug therapy was advised for any of this group, but it is of interest to note the report of Robinson (2) on the use of benzedrine sulfate in a series of nine patients. The average dose of this drug needed to prevent attacks by carotid sinus pressure was 20–40 mg. three or four times a day. One patient had insomnia and one developed a tolerance to the drug. We have not been enthusiastic about any type of prophylactic drug therapy for these patients because of the long duration of the illness and the variability of the time interval between attacks.

Minor variations in the technical factors of irradiation have not seemed to be of any importance, and we have now more or less standardized our treatment as follows: 200 kv. constant potential, 1 mm. copper and 1 mm. aluminum filter, 50 cm. target-skin distance; 400 r, measured in air, is given in one dose to one side of the neck, the opposite side being treated in the same manner on the following day. The clinician who exerts the pressure on the carotid sinus notes the area over which the response is elicited and this is then taken as the center of the field of irradiation. A 10 x 10 cm. field is usually adequate.

Tables 1 and 2 show the important findings in the 24 cases. The age of the

[1] Read before the Texas State Radiological Society, Jan. 24, 1947, Houston, Texas. Accepted for publication in March 1947.

TABLE 1

CASE	SEX	AGE	DURATION OF SYMPTOMS BEFORE X-RAY TREATMENT	TYPE OF CAROTID SINUS SYNDROME	ASSOCIATED DISEASE	BLOOD PRESSURE
1	M	37	6 years	Cerebral	Essential Hypertension	166/98
2	M	27	2 years	Vagal	None	110/70
3	M	38	12 years	Vagal	None	118/80
4	F	60	16 years	Vagal	None	150/70
5	M	66	5 years	Vagal	Arterio-sclerosis	138/80
6	F	31	10 years	Cerebral	None	124/74
7	M	34	10 years	Vagal	None	140/80
8	M	56	4 years	Vagal	None	125/85
9	M	42	2 years	Vagal	None	140/80
10	M	47	2 months	Vagal	None	112/70
11	M	64	1 year	Vagal	Essential Hypertension	180/100
12	M	68	15 years	Vagal	Arterio-sclerosis	154/90
13	M	17	1 year	Cerebral	None	110/60
14	M	71	6 years	Vagal	Arterio-sclerosis	122/78
15	M	55	10 years	Cerebral	Papillomata Larynx	110/70
16	M	56	20 years	Vagal	Bells Palsy	120/80
17	M	62	1 year	Vagal	None	150/86
18	F	29	8 years	Cerebral	None	110/80
19	M	33	8 months	Vagal	None	120/70
20	M	31	3 years	Cerebral	None	124/82
21	M	60	15 years	Vagal	None	110/70
22	F	60	2 years	Cerebral	Arterio-sclerosis	154/80
23	M	48	1 year	Vagal	None	120/80
24	M	60	5 years	Cerebral	None	108/68

patients varied from twenty-seven to seventy-one years and the duration of symptoms before roentgen therapy varied from two months to fifteen years. Eight patients showed the cerebral type of carotid sinus syndrome, while 16 had a vagal type of response on carotid sinus pressure. Only 4 of the patients in this series were females.

There was no incidence of obvious disease of the carotid sinus itself, and no patient had any type of pathologic change in the soft tissues of the neck. Hypertension and arteriosclerosis have seemed to be incidental findings. Most patients had two or more courses of roentgen therapy, and the same technical factors were used whenever the treatment was repeated.

As may be noted from the tables, 10 patients have obtained complete relief from their attacks, 6 partial relief, 4 slight, 3 none, and 1 patient could not be traced, but five months after roentgen therapy, carotid sinus pressure showed no effect.

TABLE 2

CASE	X-RAY TREATMENT	SINUS PRESSURE AFTER X-RAY TREATMENT	SYMPTOMATIC RESULT AS OF DECEMBER, 1946	DURATION OF RELIEF
1	12-37 1-38	6-38 negative	No attacks since 1-38	Complete 8 years
2	1-38 2-38	2-38 negative 2-40 negative	No attacks since 1-38	Complete 8 years
3	1-38 3-38 6-38 6-42	Positive at all times	Only slight improvement	Slight 8 years
4	5-38	Negative 10-38	Not heard from	Not traced
5	8-38 11-38	11-38 positive but mild symptoms	No attacks since 11-38	Complete 7 years 9 months
6	5-38 4-39		Attacks less frequent and severe	Partial 7 years 7 months
7	11-38 4-39 8-39	Positive	Relief for few months after each treatment	Slight
8	3-40	Negative 5-40	No change	None
9	4-40 6-40	Negative 5-41	No attacks since 5-41	Complete 5 years 7 months
10	4-40 10-40 7-43 3-44	Positive 3-44	No attacks since 3-44	Complete 2 years 1 month
11	6-40	Negative 8-40	Attacks less frequent and severe	Slight 6 years 4 months
12	6-40		No change	None
13	1-41	Slightly positive 3-41	No attacks since 3-41	Complete 5 years 9 months
14	1-41		Attacks less frequent and severe	Partial 5 years 11 months
15	2-41	Negative 3-41	Died 5-42; Ca., Colon	Complete 1 year 3 months
16	7-41	Negative 11-41	No attacks since 7-41	Complete 5 years 5 months
17	7-41 5-43	Negative 7-41 Positive 5-43	Attacks less frequent and severe	Partial 2 years 10 months
18	12-41 9-42	Positive 9-42	No change	None
19	3-42 5-42		Attacks less frequent and severe	Partial 4 years 9 months
20	6-42 7-42	Positive 7-42	Attacks less frequent	Slight 4 years 5 months
21	10-42		No attacks since 10-42	Complete 4 years 5 months
22	2-43		Attacks less frequent and severe	Partial 2 years 10 months
23	5-43 7-43	Negative 7-43	No attacks since 7-43	Complete 3 years 5 months
24	5-43		Attacks less frequent and severe	Partial 3 years 7 months

CONCLUSION

1. In a series of 24 patients with the carotid sinus syndrome in whom roentgen therapy was used as the sole therapeutic agent, 44 per cent had complete relief from their symptoms, 25 per cent partial relief, 16 per cent only slight relief, and 12 per cent obtained no benefit.

2. Roentgen therapy appears to be of definite prophylactic value, over a considerable time, in cases of the carotid sinus syndrome.

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SUMARIO

Roentgenoterapia del Síndrome del Seno Carótido

Este trabajo complementa el que apareció en RADIOLOGY **32**:209, 1939. En una serie de 24 enfermos con el síndrome del seno carótido, se utilizó la roentgenoterapia como unico tratamiento (200 kv. de potencial constante, filtro 1 mm. Cu 1 mm. Al, distancia foco-piel 50 cm.), administrándose 400 r (en el aire) a un lado del cuello un día y repitiéndose en el otro lado al día siguiente. De este grupo, 44 por ciento experimentaron completo alivio de sus síntomas, 25 por ciento alivio parcial, 16 por ciento sólo alivio leve, y 12 por ciento no se beneficiaron.

Angiography of the Thoracic Aorta and Coronary Vessels

With Direct Injection of an Opaque Solution into the Aorta[1]

DR. JORGE MENESES HOYOS[2] AND DR. CARLOS GOMEZ DEL CAMPO[3]

Mexico City, Mexico

THE POSSIBILITY of the direct injection of an opaque material into the aorta for its roentgenographic visualization has been demonstrated by dos Santos, Lamas, and Pereira Caldas (1, 2), Nelson (3), and others. These studies, however, have been limited to the abdominal aorta. Roentgenograms of the thoracic aorta have been obtained by other methods, as the injection of a contrast substance into the blood stream by way of the arm veins (4) and heart catheterization. The roentgenologic anatomy of the aorta has been studied in cadavers by Laubry, Cottenot, Routier, and Heim de Balsac (5) in France, by Snellen and Nauta (6) in Holland, and by Meneses Hoyos and Quesada (7) in Mexico City.

In four cases, to be briefly reported here, good roentgenograms were obtained following direct injection of an opaque solution into the thoracic aorta, demonstrating the aorta, its main branches, the arteries of the neck, and the coronary vessels.

The first patient in whom the procedure was employed was a young girl with a large cirsoid aneurysm of the neck, an associated arteriovenous fistula, a systolic murmur, slight cardiac enlargement, and rapid heart action. The heart condition was believed to be due to the presence of the arteriovenous fistula and the cirsoid aneurysm, but resection of the latter was considered difficult because of its apparent attachment to the subclavian artery. Arteriograms of the neck vessels following direct injection of opaque material into the thoracic aorta showed the complete independence of the artery supplying the aneurysm and containing the fistula. Resection was then carried out and the patient was restored to health. The cardiac murmur disappeared, and the heart size was shown roentgenographically to have diminished.

The second patient was a girl with an unusual type of coarctation of the aorta, the stenosis being in the aortic arch between the point of origin of the innominate artery and that of the left carotid artery. When the attempt was made to introduce the contrast solution into the aorta, some escaped into the mammary artery and the existence of a collateral circulation was demonstrated.

In the two remaining cases the procedure established the diagnosis of aneurysm of the descending aorta, excluding the possibility of a mediastinal tumor and thus preventing unnecessary surgical intervention with its attendant risk.

TECHNIC

In three of the cases sodium pentothal anesthesia was used, 6 to 10 c.c. of a 2.5 to 5 per cent solution being injected in a vein of the arm, followed by doses of 2.0 c.c., as required. In one case local anesthesia with novocaine was employed. Needless to say, the services of a trained anesthetist are essential.

The instrumental equipment required for the procedure includes: a 50-c.c. syringe filled with 70 per cent solution of Nosylan (diodrast) or other opaque medium; a 20-c.c. syringe filled with 2 to 4

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[1] Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–6, 1946.

[2] Professor of Cardiology in the University of Mexico City and in the Army Medical School and Head of the Department of Cardiology of the Central Military Hospital of Mexico; President of the College of Military Physicians of Mexico.

[3] Professor of Roentgenology in the Army Medical School of Mexico; Head of the Department of Radiology of the Central Military Hospital of Mexico and member of the Academy of Medicine.

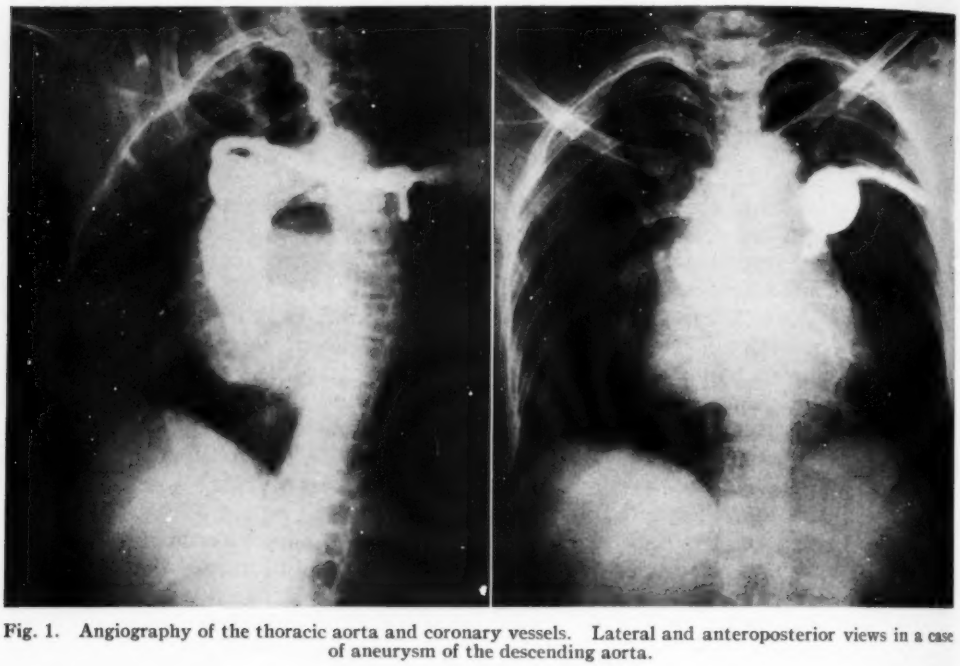

Fig. 1. Angiography of the thoracic aorta and coronary vessels. Lateral and anteroposterior views in a case of aneurysm of the descending aorta.

per cent sodium citrate solution; a long needle (12 to 15 cm.), No. 18; an aneroid manometer; rubber tubing, and a two-way valve, properly connected. A Potter-Bucky diaphragm is used.

With the patient recumbent on the x-ray table, the long needle is introduced into the second left interspace 2 cm. outside the left border of the sternum. It is directed backward and a little inward for a distance of about 10 cm. into the thorax. Rhythmic pulsation of the needle or fluoroscopic observation will show when the aorta has been entered. The needle is then connected by means of the two-way valve, either with the aneroid manometer or with the syringe containing the sodium citrate solution. When the needle is in the lumen of the aorta a blood pressure of 8 cm. mercury is recorded by the manometer or a red blood column will pass with rhythmic pulsations into the clear solution in the syringe. After injecting 5 c.c. of the citrate solution to wash the needle, the syringe is replaced by that containing the contrast medium and 30 c.c. of the solution are introduced into the aorta as rapidly as possible (in about one second). Roentgenograms are made immediately, at 80 kv., 10 ma.-seconds.

No accidents have occurred with the procedure in our experience, and we believe that it is without danger if the indications are carefully observed and technical errors are avoided. (Injection of the solution outside the vessel is to be regarded as a technical error.) One of our patients showed a fall in blood pressure but this was attributed to the anesthetic and responded favorably to the injection of coramine. In another case the patient complained of some pain in the back and a small pneumothorax was discovered, but this disappeared in two days.

INDICATIONS AND CONTRAINDICATIONS

Aortography with the aid of direct injection of a contrast solution into the thoracic aorta is indicated for the following purposes: differential diagnosis between aneurysm of the descending aorta and mediastinal tumor; differential diagnosis

between aneurysm of the innominate artery and mediastinal tumor; study of the blood supply of vascular tumors of the neck; study of collateral circulation in coarctation of the aorta; study of congenital abnormalities of the aortic arch.

The procedure should not be attempted in patients with aortic or coronary disease because of the dangers of general anesthesia. Aneurysm of the aortic arch is also a contraindication because of the damage to the aortic wall in such cases.

SUMMARY

A new method of arteriography of the thoracic aorta after direct injection of an opaque solution into the lumen of the vessel has been successfully tried by the authors. Good roentgenograms of the thoracic aorta, its main branches, the arteries of the neck, and the coronary arteries were obtained. These were useful in four selected cases in which the procedure was applied, permitting a differential diagnosis between aortic aneurysm and mediastinal tumor in two cases, determining the blood supply in one case of vascular tumor of the neck, and establishing the presence of a collateral circulation in one case of coarctation of the aorta.

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SUMARIO

Angiografía de la Aorta Torácica

Los AA. han utilizado con éxito una nueva técnica para la arteriografía de la aorta torácica después de inyectar directamente una solución opaca en la luz del vaso. Obtuviéronse buenas radiografías de la aorta torácica y sus principales ramas, las arterias del cuello, y las coronarias. Los datos acopiados resultaron útiles en cuatro casos escogidos en que se aplicó el procedimiento, permitiendo hacer el diagnóstic diferencial entre aneurisma de la aorta y tumor del mediastino en dos casos, determinar el riego sanguíneo en un caso de tumor vascular del cuello y establecer la existencia de circulación colateral en un caso de estenosis de la aorta.

Effective Wave Lengths

A New Method Independent of the Measuring Material[1]

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THERE IS NO KNOWN method of designating and measuring the quality of mixed radiation beams which does not depend on the material employed for its determination. The effective wave length idea of Duane (1) should hypothetically give effective wave lengths which are the same for a limited group of metals. When experimentally tested, however, each metal gives effective wave lengths which differ greatly from those obtained with the same radiations but with different metals (2). Naturally this leaves no hope that measurements made with a certain convenient measuring metal can be easily transposed and interpreted in terms of measurements made with another metal, in water, or in body tissues. Therefore, any hope of arriving at a definite and clear-cut meaning of so-called tissue effects or tissue doses is frustrated.

A so-called 3-point method (3) gives an absorption and a heterogeneity coefficient (μ and η), the first indicating the penetrative power of a mixed radiation beam as it enters the exposed material and the second defining the extent of change which the radiation undergoes as it penetrates the material and is thereby further filtered and homogenized or scattered and heterogenized. With the aid of these coefficients, it appears that the change in composition which the radiations undergo might be estimated to the extent that the beam emerging from the measuring material, and which is measured, could be reduced to the composition of the beam before it enters the measuring material. If this could be accomplished, a method of designating and measuring the quality of a mixed radiation beam which does not depend on the measuring material would have been found.

For satisfactory accuracy of experimental absorption data, various metals of different atomic weights are usually employed, each for a different wave length zone; also, it is known that the critical absorption bands of some metals may exclude them from experimental usage (4). It would therefore be highly advantageous if various metals employed for measuring gave wave lengths independent of the employed measuring material and covering the entire spectrum of the beam, thus avoiding the uncertainties arising from translating wave lengths belonging to one metal into wave lengths belonging to another metal or to water or body tissues. In this paper, experimental proof will be presented demonstrating that the 3-point method is capable of yielding these results.

This new method basically is Duane's effective wave length idea, but with an added provision which eliminates selective changes of the composition of the beam in the measuring material. Experimental proof will be offered showing that the effective wave lengths obtained by the new method are the same for a selected group of measuring metals.

THE PROBLEM

Data which are obtained from tests upon a radiation beam to define statistically its quality constitute an absorption curve or one of the several known short-cut methods of representing it. The half-value layer and the effective wave length methods are attempts with 2 points to define an absorption curve. While there are mathematical as well as

[1] From the X-Ray Department of the New York Post-Graduate Medical School and Hospital, Wm. H. Meyer, M.D., Director. Accepted for publication in April 1947.

experimental objections to these short-cut methods, in lieu of better ones, they have in the past been highly useful.

The 3-point method of defining an absorption curve is slightly more complicated for use, but it overcomes many of the objections to the 2-point methods. For example, the change of composition of the beam and of its rate of absorption at various depths is better defined by the 3-point method. The failure to meet the theoretical requirement of independence of the measuring material in the effective wave length method as devised by Duane will be shown herein to be ascribable to the use of but 2 points. This failure is overcome with the 3-point method, and the data to be presented are additional examples of better representation of an absorption curve by the latter method.

The 3-point method is experimentally carried out by measuring the intensities of the original beam I_0, through 0.25 mm. I_1 and through 1.0 mm. of the measuring metal I_2. From these data the linear absorption coefficient μ is calculated with the relation

$$(\log I_0 - \log I_1)92 = \mu; \quad (92 = 4e \cdot 10) \quad (1)$$

The heterogeneity coefficient η is obtained with the formula

$$\mu - (\log I_0 - \log I_2)23 = \eta; \quad (23 = e \cdot 10) \quad (2)$$

or, for easier calculation,

$$(3 \log I_0 + \log I_2 - 4 \log I_1)23 = \eta \quad (2a)$$

and the equation which represents the absorption curve and of which η is the coefficient of the square term and μ of the linear term, is: $\eta x^2 - \mu x - \log I_0 = 0$.

Obviously the I_1 value defined above is measured after the radiation has passed through the measuring material whereby its composition is changed, but this specific absorption or change of composition of the beam is reduced, in part at least, by making the metal layer very thin. When greater material thicknesses, for example I_2, are to be penetrated, it is required that the rate of change of the absorption coefficient be known and applied. This is the heterogeneity coefficient η and the complex absorption coefficient then becomes $\mu + x\eta$) (5).

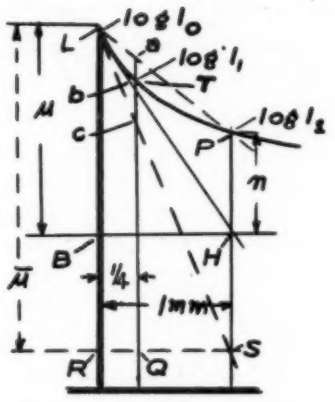

Fig. 1. Geometrical definition of absorption and heterogeneity coefficients of radiation beams.

In the accompanying diagram (Fig. 1), *L-T-P* is a semilogarithmic absorption curve of measured data. *R-Q* is 0.25 mm. and *R-S* is 1.0 mm. Hence, $L = \log I_0$, $T = \log I_1$, and $P = \log I_2$. As is usual, the linear absorption coefficient μ is calculated with formula (1), and the heterogeneity coefficient η with formula (2) or (2*a*), and $L\text{-}B = \mu$, $P\text{-}H = \eta$, and $L\text{-}R = \bar{\mu}$, which is the absorption coefficient of the beam as it comes from the x-ray tube and through the filters used.

But μ, instead of being a tangent, actually is a secant, and its real value, instead of *L-H-B*, should be *L-S-R*. However, it has been shown that, by measuring through 1.0 mm. thickness, the absorption coefficient μ of the original beam is increased from μ to $(\mu + x\eta)$, and it follows by similarity that the absorption coefficient μ measured through 0.25 mm. of the measuring material, to represent the composition of the original incident beam, would have to be increased in the same proportion. Thus, if $P\text{-}H = \eta$, $a\text{-}b = \eta/4$. If the absorption curve follows the general equation, $\eta x^2 - \mu x - \log I_0 = 0$, then the value of the heterogeneity coefficient η should be proportional to the thickness x of the absorbing material and $P\text{-}H = H\text{-}S$. Hence,

$$\log I_0 - (\log I_1 - \eta/4)92 = \bar{\mu} \qquad (3)$$

or, if the absorption and the heterogeneity coefficients have already been calculated,

$$\mu + 23\,\eta = \bar{\mu} \qquad (3a)$$

wherein $\bar{\mu}$ is the true or effective absorption coefficient of the incident beam without any change of composition which might have been caused by specific absorption in the material used.

This $\bar{\mu}$, therefore, is the effective absorption coefficient of the original beam on the assumption that its composition is not changed while it passes through the measuring metal. The intensity of the beam is assumed to be reduced about the same as of an equivalent monochromatic beam whose wave length does not change with penetration of material.

Specific absorption in the measuring material thus being compensated for and eliminated, the same wave length values should be obtained by this method for any material (provided that the critical absorption band is outside the used wave length band of the beam) that may be substituted, and these effective wave lengths could be used as a designation of the penetrative qualities of the beam.

To Duane's (1) original definition

> "The effective wave length is the wave length of a monochromatic beam of rays for which the reading of a measuring instrument would be reduced in the same ratio as for the actual beam, when a sheet of absorbing material is placed in the path of the rays,"

there should be added:

> "and correction is made for additional selective filtration in each of the measuring materials employed."

This new definition of effective wave length is verified by showing that, experimentally measured with each of a great variety of radiation beams, the effective wave lengths determined with various metals are the same.

EXPERIMENTAL

A large part of the initial experimental work failed to confirm the theoretically expected conclusions; but greater accuracy achieved through the working out of experimental details and precautions finally led to satisfactory results. Rather than devote space to the discarded procedures, we shall describe in some detail the new methods worked out and the experimental precautions found necessary for consistent results.

A constantly reading instrument was found most suitable for best results. The ionization current from a thin-walled ionization chamber of thimble type is passed through a large resistance and with the aid of a quadrant electrometer the voltage along this resistance is measured. This constantly reading instrument indicates voltage fluctuations and unsteadiness of the radiation output from the x-ray tube. Readings were taken only during periods of steadiness and, as the measuring metal sheets can be changed quickly, a sufficient number of observations under conditions known to be controlled and normal can easily be made. Since the experimental accuracy depends on accurate ratios between the readings through various absorber thicknesses, this procedure proved distinctly superior to that with condenser discharge type instruments or measurements involving a time measure during which absolute constancy of the output is essential.

The absorbing material was backed-up with a screening metal for its characteristic K-radiation; without this, discouraging discrepancies and irregularities in the results may lead to disaffirmation of the theoretical conclusions (6). But 0.5 mm. Al in addition to each of the absorbing materials used (Al, Cu, Sn, and Pb) causes the results of repeated measurements to gain distinctly in uniformity. All the reported measurements were made with 0.5 mm. Al next to the ionization chamber; in addition to this, an air space of at least 10.0 cm. was present between the filter and the chamber (7).

The thickness of the absorber material was determined from the density and the weight per square centimeter of the metal

sheets; the weight per square centimeter is equal to the density times the thickness in centimeters. Considerable variations were found in the density of several samples of the same metal, indicating the importance of using only pieces from the same sheets.

The area of the radiation beams was held constant and at the ionization chamber about 100 times as large as the chamber itself. This is to make certain of a constant addition of scattered radiation from the surrounding air volume, which, therefore, must be kept constant. All scattering material except air must be definitely outside the irradiated air volume; all holders for the metal sheets and for the ionization chamber were of material whose density and atomic weight are as small as possible. The best method found is to support these parts with cotton ribbons and strings.

The method of calculating the data of the accompanying table is illustrated by an example. For line 24 for 200 kv. 0.5 mm. Cu radiation, the Cu data measured with constant voltage at the x-ray tube are, $I_0 = 15.0$, $I_1 = 11.6$, $I_2 = 6.02$.

With formula (1), $(1.1818 - 1.0645)92 = 10.8 = \mu$.

With (2), $(3 \times 1.1818 + 0.7796 - 4 \times 1.0645)23 = 1.54 = \eta$.

With (2a), $10.8 + 23 \times 0.7796 - 23 \times 1.1818 = 1.54 = \eta$.

With (3), $10.8 + 23 \times 1.54 = 44.2 = \bar{\mu}$ and $44.2\bar{\mu} = 0.31$ Å.U.

The numerical values of the effective absorption coefficient $\bar{\mu}$ having been thus obtained, these are translated into effective wave length values with the aid of Allen's tables (8), but the data given are multiplied by the density of the materials, 2.7 for Al, 8.95 for Cu, 5.75 for Sn. The wave lengths obtained are in Ångstrom units and are those of a monochromatic radiation which changes the readings of instruments (and probably other effects) the same as the mixed beam tested.

DISCUSSION

By showing that the effective wave lengths obtained with all of the metals employed are the same, the experimental data affirm the validity of formulae (3) and (3a), and that the heterogeneity coefficient η is a measure of the change in the composition of the beam as it passes through the measuring material.

The experimental data also affirm Duane's finding that materials of very low atomic weight should not be employed, because their absorption coefficients do not change very much with the wave lengths in the region of the short wave lengths employed in deep roentgen therapy. For determination with Al, an unusual degree of experimental accuracy, enhanced by averaging a large number of readings, was found necessary for obtaining the agreement in the results as reported.

With Cu, for which the critical absorption wave length is much longer than the wave lengths of the ordinarily employed beams, satisfactory results are obtained, particularly with the longer and medium long wave lengths. For deep therapy radiation beams down to $\lambda = 0.42$ Å.U., especially good readings are obtained with Sn, but for longer wave lengths the readings were erratic and generally much too high. The critical absorption wave length for Pb is at $\lambda = 0.142$ Å.U. and well within the wave length bands employed in therapy. The readings with Pb were found erratic and not usable for effective wave length determinations of the bands ordinarily employed in radiation therapy.

Because of experimental facts revealed by measurements with old type x-ray tubes and with newer shock-proof and ray-proof tubes with the same voltage and filters, an equivalence of window material of modern x-ray tubes (glass, oil and plastic compounds) in terms of one of the metals employed as a homogenizing filter (Al, Cu, etc.) can consistently not be so stated, and the magnitude of possible errors, and the consequent risk, are far greater than can be justified. A designation of effective wave length with a definitely known voltage applied to the x-ray tube appears better suited to describe the efficacy of such window materials.

TABULATION OF RESULTS

No.	Voltage Filter	μ			η			μ/η			$\bar{\mu}$			$\lambda_{eff.}$ Å.U.			$\nu_{eff.} \times 10^{18}$			Series
		Al	Cu	Sn	Al	Cu	Sn	Al	Cu	Sn	Al	Cu	Sn	Al	Cu	Sn	Al	Cu	Sn	
1	100 n.f.	2.07	60.0		1.09	31.5		1.9	1.9		27.0	786.3		0.89	0.88		2.68	2.65		H
2	100 n.f.	1.90	57.0		1.05	31.6		1.8	1.8		26.2	783.3		0.88	0.88		2.65	2.65		K
3	100 n.f.	1.70	65.0		0.98	33.4		1.75	1.95		24.0	832.4		0.90	0.89		2.70	2.68		L
								(1.82)	(1.88)					(0.89)	(0.88)		(2.68)	(2.65)		
4	130 n.f.	1.30	39.6		0.73	20.8		1.8	1.9		18.0	517.9		0.70	0.80		2.10	2.40		H
5	130 n.f.	1.62	47.5		0.81	19.8		2.0	2.4		20.2	502.2		0.80	0.78		2.40	2.35		K
6	130 n.f.	2.00	54.0		0.84	27.0		2.4	2.0		21.2	670.8		0.87	0.80		2.61	2.40		L
								(2.1)	(2.1)					(0.79)	(0.80)		(2.37)	(2.40)		
7	100 1 Al	1.58	59.6		0.51	22.8		2.6	2.6		15.6	586.5		0.72	0.74		2.16	2.22		H
8	100 1 Al	1.32	41.0		0.55	16.5		2.4	2.4		13.4	420.0		0.68	0.70		2.05	2.10		K
								(2.5)	(2.5)					(0.70)	(0.72)		(2.20)	(2.16)		
9	130 1 Al	1.40	41.2		0.48	14.2		2.9	2.9		12.4	367.0		0.70	0.66		2.10	1.97		L
10	130 1 Al	1.24	39.2		0.52	16.3		2.4	2.4		13.1	413.0		0.73	0.70		2.20	2.10		R
								(2.6)	(2.6)					(0.71)	(0.68)		(2.13)	(2.05)		
11	100 2 Al	1.26	40.0		0.49	14.9		2.5	2.7		12.6	382		0.66	0.68		1.97	2.04		H
								(2.5)	(2.5)					(0.66)	(0.68)		(1.97)	(2.04)		
12	130 2 Al	1.11	39.4		0.366	12.3		3.1	3.2		9.57	322		0.63	0.64		1.89	1.92		H
13	130 2 Al	1.10	37.0		0.364	13.9		3.0	3.1		9.5	310		0.61	0.63		1.84	1.90		K
14	130 2 Al	1.34	41.5		0.42	13.0		3.2	3.2		11.0	340		0.65	0.64		1.95	1.92		L
								(3.1)	(3.2)					(0.63)	(0.64)		(1.90)	(1.92)		
15	130 4 Al	1.08	37.2		0.34	11.0		3.2	3.4		8.9	289.8		0.58)	0.60		1.74	1.80		H
16	130 4 Al	1.00	31.5		0.325	11.5		3.1	3.0		8.5	272		0.58	0.59		1.74	1.77		K
17	130 4 Al	1.16	37.2		0.333	11.6		3.4	3.3		8.8	304.3		0.62	0.61		1.86	1.83		L
								(3.2)	(3.2)					(0.59)	(0.60)		(1.78)	(1.80)		
18	180 0.25 Cu	0.605	19.4		0.12	3.9		5.0	5.0		3.4	108.5		0.44	0.43		1.32	1.29		N
								(5.0)	(5.0)					(0.44)	(0.43)		(1.32)	(1.29)		
19	180 0.5 Cu	0.38	10.7		0.062	1.70		6.1	6.3		1.81	50		0.35	0.36		1.05	1.08		N
								(6.1)	(6.3)					(0.35)	(0.36)		(1.05)	(1.08)		
20	180 0.75 Cu	0.266	7.7		0.04	1.01		6.7	6.8		1.18	31		0.26	0.28		0.78	0.84		N
								(6.7)	(6.8)					(0.26)	(0.28)		(0.78)	(0.84)		
21	180 1.75 Cu	0.236	6.5		0.033	0.81		7.1	8.0		1.00	25.2		0.25	0.25		0.75	0.75		N
								(7.1)	(8.0)					(0.25)	(0.25)		(0.75)	(0.75)		
22	200 0.25 Cu	0.615	18.4	44.5	0.012	3.52	8.55	5.2	5.2	5.2	2.98	99.7	241	0.42	0.43	0.41	1.26	1.29	1.23	MQ
23	200 0.25 Cu	0.56	17.2		0.011	3.25		5.1	5.3		3.10	92		0.40	0.41		1.20	1.23		S
								(5.2)	(5.2)	(5.2)				(0.41)	(0.42)	(0.41)	(1.23)	(1.26)	(1.23)	
24	200 0.5 Cu	0.365	10.8	28.0	0.052	1.54	4.00	7.0	7.0	7.0	1.56	44.2	120	0.31	0.31	0.31	0.93	0.93	0.93	MQ
25	200 0.5 Cu	0.33	9.6		0.049	1.41		6.8	6.8		1.45	42.1		0.28	0.30		0.84	0.90		O
26	200 0.5 Cu	0.38	9.5		0.057	1.42		6.7	6.7		1.68	41		0.32	0.32		0.96	0.96		P
27	200 0.5 Cu	0.32	9.25		0.050	1.34		6.4	6.9		1.47	40		0.30	0.30		0.90	0.90		S
								(6.7)	(6.8)	(7.0)				(0.30)	(0.31)	(0.31)	(0.90)	(0.93)	(0.93)	
28	200 0.75 Cu	0.234	5.5	13.6	0.027	0.64	1 58	8.6	8.6	8.6	0.86	20.2	50	0.22	0.23	0.23	0.66	0.69	0.69	MQ
29	200 0.75 Cu	0.224	5.35		0.026	0.63		8.5	8.5		0.83	19.8		0.21	0.22		0.63	0.66		O
30	200 0.75 Cu	0.250	5.45		0.029	0.635		8.6	8.6		0.92	20		0.24	0.23		0.72	0.69		P
31	200 0.75 Cu	0.250	5.32		0.028	0.605		8.8	8.8		0.90	18.6		0.23	0.24		0.69	0.72		S
								(8.6)	(8.6)	(8.6)				(0.23)	(0.23)	(0.23)	(0.69)	(0.69)	(0.69)	
32	200 2 Cu	0.214	2.55	12.0	0.018	0.296	1.03	11.6	11.6	11.6	0.64	10.2	35.6	0.19	0.19	0.20	0.57	0.57	0.60	MQ
33	200 2 Cu	0.223	3.64		0.020	0.33		11.0	11.0		0.69	11.2		0.18	0.19		0.54	0.57		O
34	200 2 Cu	0.221	4.08		0.018	0.34		12.0	12.0		0.65	11.9		0.18	0.17		0.54	0.51		P
35	200 2 Cu	0.217	3.65		0.019	0.33		11.0	11.0		0.67	11.3		0.19	0.16		0.57	0.48		S
								(11.3)	(11.4)	(11.6)				(0.18)	(0.18)	(0.20)	(0.54)	(0.54)	(0.60)	

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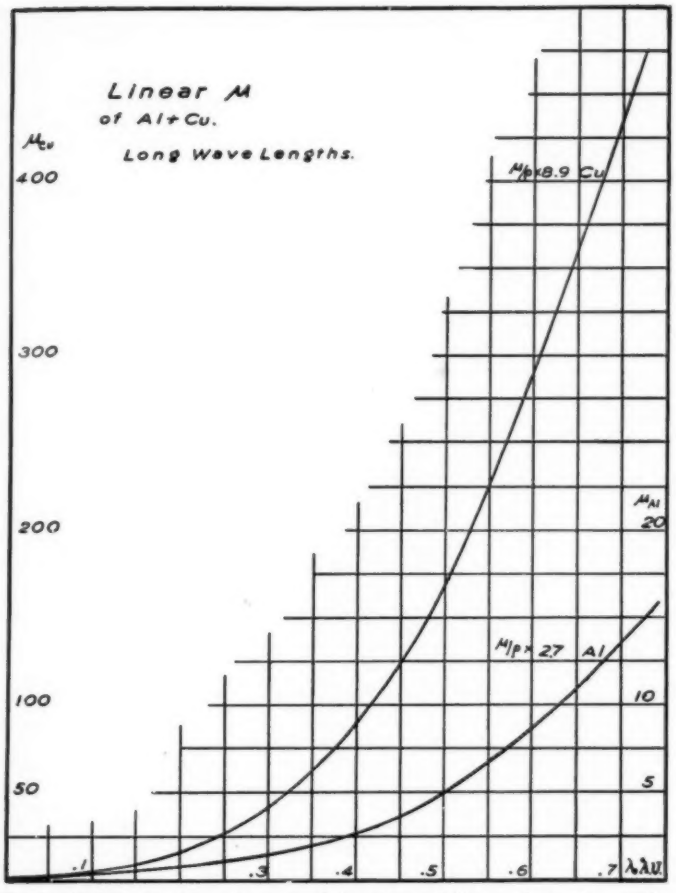

Fig. 2. Relation between long wave lengths and linear absorption coefficients in Cu and Al.

The wave length tables of Allen list mass-absorption coefficients, *i.e.*, the linear absorption coefficient μ divided by the density ρ of the material, μ/ρ. However, the linear and not the mass absorption coefficients are found to give consistent results in terms of effective wave lengths. The mass absorption coefficient may have definite significance with respect to atomic properties, but the relation of wave length to absorption coefficient as employed in radiation therapy is without reference to either atomic patterns or structures of the irradiated materials. Moreover, the determination of the 3 points I_0, I_1, and I_2 is based on linear dimensions of the material and without considering ρ, its density[2].

In the table are given the absorption coefficients μ as calculated by the usual method and according to formula (1); there is also given the effective absorption coefficient $\bar{\mu}$, which is generally larger than the former. The tables of Allen contain absorption coefficients for mono-

[2] Several empirical formulae expressing ratios between absorption coefficients and wave lengths have been derived in the past (Richtmyer, Duane, Jönsson, Victoreen, etc.). These do not agree, in all instances, with experimental data but simply approach them.

It is generally desirable to give preference to broad theoretical expressions over direct experimental data. Where an experimental method of determining effective wave lengths is concerned, the wave length data from a formula would deviate, as expected from measured values. Best correlation was obtained with the experimental data of Allen's tables and less accurate with the calculated data of Victoreen.

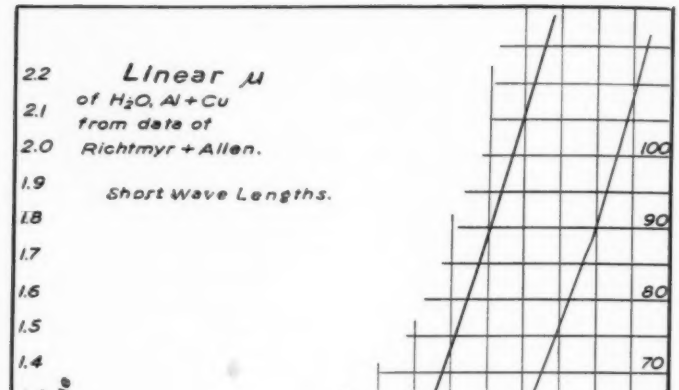

Fig. 3. Relation between short wave lengths and linear absorption coefficients in Cu, Al, and water.

chromatic beams and as obtained by the same conventional method. These relations are correct for single or monochromatic wave lengths and provided that, through scattering, the composition of the beam was not changed or softened materially. Experimentally, if secondary radiation is effectively prevented from reaching the measuring instrument, this proposition is proved to be correct.

However, these experiments also bear out the fact that when a mixed beam is passed through a material, the longer wave lengths are decreased in a greater proportion than the shorter wave lengths, and this proportion increases with the higher atomic materials. Therefore, the higher the atomic weight of a filter material, the better (for the same percentage total decrease of the beam) its homogenizing action. Therefore, the lower the atomic weight of the material to be penetrated and the higher the atomic weight of the filter material, that much greater will be the intensity of the beam at a certain depth of the penetrated material.

The results tabulated also disclose that for all the metals employed for the measurements, for each kilovoltage and filter, the ratio μ/η is constant. It is smallest for the least filtered x-ray beam and is largest for the thickest filters employed. The

absorption coefficient depends largely upon the kilovoltage applied to the x-ray tube. The depth action of a radiation beam is greatest if the absorption coefficient is small and the heterogeneity coefficient is large; the action of the beam is at a small distance from the surface if the absorption coefficient is large and the heterogeneity coefficient is small. The ratio μ/η thus is a measure of the effect of voltage and of filtration upon the depth at which pronounced radiation effects are to be caused. This important proposition is the subject of a special communication (9).

A physical interpretation of the two absorption coefficients μ and $\bar{\mu}$ may appear to offer some difficulties. However, the ordinary linear or mass absorption coefficients μ or μ/ρ are applicable to monochromatic beams and, if the experimental precautions outlined are observed, the experimental results are consistent with the theory. For polychromatic beams, agreement with theory for this absorption coefficient fails; the effective absorption coefficient $\bar{\mu}$ or $\bar{\mu}/\rho$, as herein presented, gives experimental results in full agreement with the theory with non-homogeneous x-ray beams, as those used for therapeutic irradiation of biological lesions.

Figures 2 and 3 are graphic representations of the relation of linear absorption coefficients of monochromatic x-ray beams and wave lengths in Å.U. Figure 2 is for low penetrating (long λ) beams and Figure 3 is for highly penetrating (short λ) beams.

Effective frequency designation of radiation quality (the reciprocal of the effective wave lengths) is in many respects more convenient for use and better descriptive of variations of quality effects. To change from wave length to frequency (ν) designation of radiations, as was done in the high-frequency and radio technics, is desirable; hence in the table of results, in the last column the frequencies (ν) alongside of the wave lengths (λ) are given.

SUMMARY

It is shown that:

(1) With aluminum, copper, and tin as measuring materials, the wave lengths of monochromatic radiation which correspond with the absorption coefficient μ, for each of the selected radiation qualities (kilovolts and filters), are different for each of these metals.

(2) With aluminum, copper, and tin as measuring materials, wave lengths of monochromatic radiations corresponding to the effective absorption coefficient $\bar{\mu}$ for each of the selected radiation qualities (kilovolts and filters) are the same for each of these metals.

(3) The difference between the absorption coefficient μ and the effective absorption coefficient $\bar{\mu}$ of a material is the heterogeneity coefficient η; *i.e.*, $\mu + 23\eta = \bar{\mu}$.

(4) A new definition for effective wave length of x-ray beams, and a method of calculating it based upon the 3-point method of defining an absorption curve, are given.

(5) Tin as measuring metal is suitable for beams of less than 0.42 Å.U.; below this critical absorption wave length the results are erratic and not consistent with the theory.

(6) Lead as a measuring metal is suitable for beams of less than 0.142 Å.U.; below this critical absorption wave length the results are erratic and not consistent with the theory.

(7) Aluminum as a measuring metal is suitable for the long wave lengths (low voltages and thin filters); for the short wave lengths the changes in ionization are small and a satisfactory degree of accuracy is not easily obtained.

(8) Copper as a measuring metal is suitable for the customary wave length bands employed in radiation therapy except the very long wave length bands (below 9 kilovolts) and the very short wave length bands (above 200 kilovolts and 2 mm. Cu filter.)

(9) Details of an experimental procedure for measuring the coefficients which determine an absorption curve by the 3-point method are given, and precautions necessary for consistent results are suggested.

(10) The absorption coefficient μ as customarily measured with x-ray beams is erroneous because of having been measured with a non-descript change of composition of the beam; the effective absorption coefficient $\bar{\mu}$ has physical significance because it is not dependent on the characteristics of the measuring material.

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SUMARIO

Largos de Onda Eficaces: Nueva Técnica Independiente de la Sustancia de Medición

(1) Al emplear aluminio, cobre y estaño como sustancias de medición, varían para cada uno de estos metales los largos de onda de la radiación monocromática correspondientes al coeficiente de absorción μ, para cado uno de los elementos de radiación escogidos (kilovoltios y filtros).

(2) En cambio, al emplear aluminio, cobre y estaño como sustancias de medición resultan idénticos para los tres metales los largos de onda de la radiación monocromática correspondiente al coeficiente de absorción efectiva $\bar{\mu}$, para cada uno de los elementos de radiación escogidos (kilovoltios y filtros).

(3) La diferencia entre el coeficiente de absorción μ y el coeficiente de absorción efectiva $\bar{\mu}$ de una sustancia constituye el coeficiente de heterogeneidad η; es decir, $\mu + 23\eta = \bar{\mu}$.

(4) Ofrécense una nueva definición del largo de onda efectivo de los haces de rayos X y una técnica para calcularlo, basada en el método de los 3 puntos para definir una curva de absorción.

(5) El estaño como metal de medición resulta apropiado para los haces de menos de 0.42° U. A.; por debajo de dicho largo de onda crítico de absorción los resultados son inconstantes e incompatibles con la teoría avanzada.

(6) El plomo como metal de medición resulta apropiado para los haces de menos de 0.142° U. A.; por debajo de ese largo de onda crítico de absorción los resultados son inconstantes e incompatibles con la teoría.

(7) El aluminio como metal de medición resulta apropiado para los largos de onda largos (voltajes bajos y filtros delgados); para los cortos los cambios en la yonización son pequeños y no se obtiene fácilmente una exactitud satisfactoria.

(8) El cobre como metal de medición resulta apropiado para las franjas empleadas habitualmente en radioterapia, aparte de las muy largas (por debajo de 9 kilovoltios) y las muy cortas (por encima de 200 kilovoltios y 2 mm. de filtración por Cu).

(9) Preséntanse los pormenores de un procedimiento experimental para medir los coeficientes que determinan una curva de absorción por el método de los 3 puntos, e indícanse las precauciones necesarias para obtener constancia en los resultados.

(10) El coeficiente de absorción μ, según se suele medir con haces de rayos X, resulta erróneo, por haberse medido con un haz de composición variable e indeterminable; en cambio, el coeficiente de absorción efectiva μ posee importancia física, por no depender de las características de la sustancia empleada para medición.

Infrapulmonary Effusion Masquerading as an Elevated Diaphragm[1]

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THE OCCURRENCE of a pleural exudate between the inferior surface of the lung and the diaphragm is but rarely seen and rarely recognized as such when present. Roentgenologically the infrapulmonary effusion may give the appearance of an elevated, well arched diaphragm with a clear, sharp costophrenic angle and a well defined pseudo-diaphragmatic shadow. Fluoroscopically an infrapulmonary effusion may be seen to move as a unit much as does the diaphragm itself.

Physical signs may be suggestive in some cases—dullness to flatness in the lower half of the chest on percussion and diminution or absence of breath sounds on auscultation. These signs, however, occur with an elevated splinted diaphragm, whatever the cause, as well as with an effusion. Fluid shift can sometimes be demonstrated fluoroscopically. The differential diagnosis from such conditions as subdiaphragmatic abscess, enlarged liver, paralysis of the diaphragm, and eventration of the diaphragm, can be safely and quickly made with the use of two procedures: (1) examination in the lateral decubitus or supine position to demonstrate shift of fluid or fluid level in the anteroposterior chest film; (2) diagnostic pneumoperitoneum.

The first of these procedures is supposedly the simpler but, should the infrapulmonary effusion be completely encapsulated, a shift of the fluid cannot be expected. Diagnostic pneumoperitoneum can be done with little or no danger; it always clearly identifies the position of the diaphragm and may even demonstrate effusions too small to be detected by the positioning technic.

Few cases of infrapulmonary effusions simulating an elevated diaphragm have been reported. Rigler (1) was the first to mention such cases in 1931. In two of the cases reported by him, the roentgenograms showed an elevated, arched, pseudo-diaphragmatic shadow with a clear costophrenic angle. One of his patients was a child with nephrosis; the other had a metastatic carcinoma with pleural effusion. The diagnosis in the latter case had been an elevated diaphragm due to an enlarged carcinomatous liver.

Yater and Rodis (2) reported a case of tuberculous serositis in which the diaphragm was apparently elevated, but fluoroscopy demonstrated a fluid wave as well as a mediastinal shift. Postmortem examination failed to furnish any explanation for the atypical roentgen appearance of the fluid.

Recently Parsonnet, Klosk, and Bernstein (3) reported three cases of infrapulmonary transudates which occurred in congestive heart failure, and which could not be distinguished on the roentgenogram from a raised diaphragm. They demonstrated the value of pneumoperitoneum and re-emphasized the importance of the Rigler (4) positioning technic. Their third case was diagnosed only postmortem, but no explanation was offered for the atypical roentgen appearance of the pleural transudate. In two of the three cases the roentgenologic report had been "elevated diaphragm due to congested liver" and in the third "subphrenic abscess."

The need for differentiating an infrapulmonary effusion from an elevated diaphragm is obvious, especially if unwarranted surgery can thus be avoided. In one of the cases of congestive heart failure

[1] From the National Jewish Hospital at Denver (Dr. Allan Hurst, Medical Director) and the University of Colorado School of Medicine, Denver, Colo. Accepted for publication in May 1947.

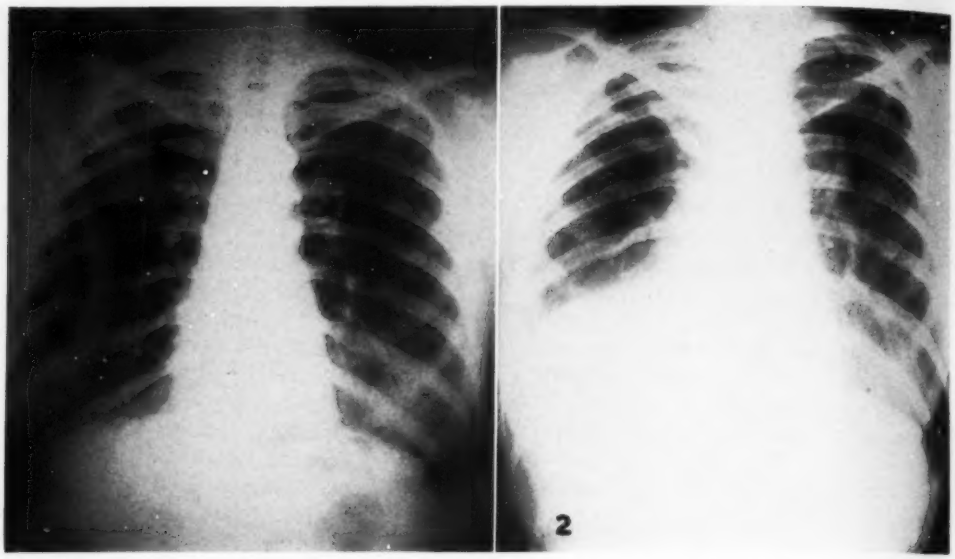

Fig. 1. Aug. 15, 1946. Postero-anterior film showing bilateral apical and subapical fibro-productive lesions most prominent on the right.

Fig. 2. Nov. 30, 1946. Postero-anterior film showing what appears to be an elevated diaphragm with a clear costophrenic angle. Some diffuse cloudiness over the diaphragm and especially along the mediastinum was noted, but this was felt to be due to compression on the base of the lung.

reported by Parsonnet, Klosk, and Bernstein (3), an incorrect diagnosis of subphrenic abscess had been made until pneumoperitoneum revealed the infrapulmonary effusion. Differentiating an infrapulmonary effusion from an enlarged liver is also of great importance in congestive heart failure, for a simple thoracentesis may afford the patient notable relief of his dyspnea.

A typical example of an infrapulmonary effusion masquerading as an elevated diaphragm follows. It is presented to redirect attention to this type of case.

CASE REPORT

V. P., a 27-year-old white female, was admitted to the National Jewish Hospital on May 15, 1945, with a diagnosis of pulmonary tuberculosis. A chest film revealed bilateral fibro-productive apical and subapical lesions. During the patient's stay in the hospital a right cervical adenopathy developed and was recognized as tuberculous. The lymphadenopathy responded slowly to x-ray therapy. Sputum examination was positive on rare occasions, but the patient continued to show improvement clinically.

On Oct. 29, 1946, fluoroscopic examination was done because of right lower chest pain. The pain was mild but had persisted for one week. Fluoroscopy revealed what appeared to be a well elevated, arched diaphragm on the right. Motion was limited to one interspace. The costophrenic angle was clear, and no fluid shift could be detected. A roentgenogram of the chest gave the appearance of an elevated diaphragm; a lateral film was non-contributory.

Physical examination revealed dullness to percussion, with decreased to absent breath sounds in the lower half of the right chest. The patient began to run a low-grade temperature and continued to complain of right lower chest pain aggravated by deep respiration.

Because of the presence of a cervical adenopathy, the initial impression was that mediastinal nodes were exerting pressure against the phrenic nerve, with consequent diaphragmatic paralysis. This was quickly ruled out because of the symptoms of chest pain, the low-grade temperature, and the fact that on fluoroscopy the diaphragmatic shadow could be seen to move, although to a limited extent.

Diagnostic pneumoperitoneum was initiated Nov. 1, 1946, and clearly demonstrated an infrapulmonary effusion. An anteroposterior film of the chest with the patient kept in the right lateral decubitus position for five minutes revealed a well defined fluid level in the lateral costal gutter. It was also evident that some of the fluid remained in the infrapulmonary space even at the end of the five minutes.

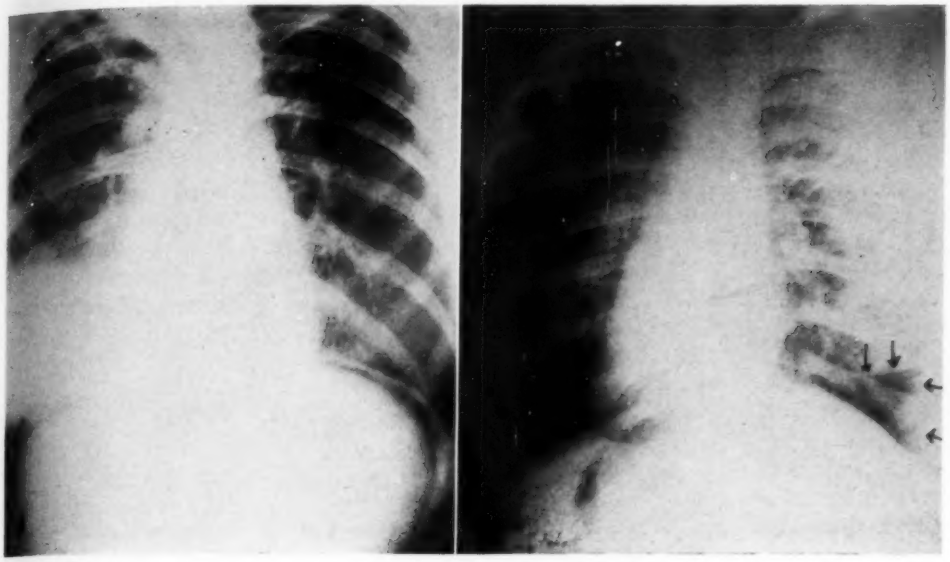

Fig. 3. Dec. 1, 1946. Diagnostic pneumoperitoneum revealing the infrapulmonary effusion.
Fig. 4. Dec. 1, 1946. Roentgenogram with patient in the right lateral decubitus position, showing a fluid level in the right lateral costal gutter. The interlobar fissure is well defined due to seepage and shift of the pleural fluid.

Diagnostic thoracentesis revealed a clear amber fluid negative for acid-fast bacilli.

The patient was placed on strict bed rest, and subsequent films showed gradual clearing of the effusion. The most recent film revealed that the fluid in the chest had finally taken on the usual configuration seen in pleural effusions, with a convex upper border and a blunting of the costophrenic angle.

DISCUSSION

The usual distribution of free pleural effusions was first described by Demoiseau in 1834, but it was Ellis who, thirty years later, carefully documented it and popularized the Ellis S-curve.

Early in the course of a pleural effusion, blunting of the costophrenic angle is noted, with some flattening of the diaphragm. As the fluid increases in amount, its upper level curves superiorly and laterally, as demonstrated on the roentgenogram. On a lateral film it is noted that the effusion usually curves higher posteriorly than anteriorly, but with the highest visible point usually in the axilla. The most important factors involved in this phenomenon are: (1) gravity, (2) retractibility of the lung, (3) capillary attraction, (4) surface tension of the fluid.

Gravity causes the fluid to seek the most dependent portions of the pleural space. The retractibility or elasticity of the lung determines what portion of it is most easily displaced. Acting together, these two forces tend to cause the fluid to displace the most peripheral and lowermost portions of the lung, starting first with the area in the costophrenic angle. Capillary attraction caused by close proximity of the parietal and visceral pleura in the uncollapsed portions of the lung tends to act against gravity and pulls the fluid upward. This force is most active in the axilla. The fourth factor involved is the surface tension of the fluid; the lower this is, the more the force of capillary attraction is augmented.

It can readily be seen that any alteration of the factors mentioned above, such as decrease in lung elasticity, pleural adhesions, and pleural thickening, could cause innumerable variations.

A logical explanation for the simulation of an elevated diaphragm by an infra-

pulmonary effusion with limited fluid shift requires the postulation of partial adhesions at the costophrenic angle. Accumulating fluid would then tend to displace the under surface of the lung, arching it upwards, producing the appearance of an elevated diaphragm. Since the fluid is not completely encapsulated, it must undoubtedly seep upward around the peripheral portions of the lung, but in such a thin layer as to be undetectable.

Kaunitz (5) has demonstrated with intrapleural injection of iodized oil that the fluid level in the chest film showing a typical configuration of a pleural effusion is actually much higher than is detectable roentgenologically.

In observation of our own case it was noted that in lateral decubitus a fairly free shift of fluid could be seen, but that a good proportion of the fluid remained in the space between the base of the lung and the diaphragm. This would seem to bear out the above conclusion. Proof, however, has not been forthcoming to establish this as a satisfactory explanation of the phenomenon, since two reported cases (2, 3) failed to show the presence of such adhesions at necropsy.

SUMMARY

A case of infrapulmonary effusion masquerading as an elevated diaphragm has been presented. Attention is re-directed to the importance of diagnostic pneumoperitoneum in elucidating this condition.

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SUMARIO

Derrame Infrapulmonar Simulando Elevación del Diafragma

Como medio de distinguir un derrame infrapulmonar de una elevación del diafragma sugiérense el examen radiológico en decúbito lateral o supino para descubrir una desviación del líquido o del nivel del líquido en la película torácica anteroposterior y el neumoperitoneo diagnóstico. Comunícase un caso.

Basal Pleural Fluid Accumulations Resembling Elevated Diaphragm[1]

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IT IS DIFFICULT to explain why fluid may sometimes collect between the under surface of the lung and the diaphragm without spreading freely in the greater pleural space. It is hoped that the presentation and discussion of some examples of this situation will be of assistance in the better understanding of this phenomenon.

Others have observed and recorded this occurrence and have listed the factors which they regard as important in the mechanics of the process. Rigler (1) described clearly some of the forces which modify the effects of gravity on fluid accumulation in the pleural space. According to him, these modifying factors are: (1) retractility of the lung, which may in turn be altered by the presence of consolidation, fibrosis, cavitation, emphysema, or atelectasis; (2) a tendency to cohesion between pleural surfaces, producing an effect of capillarity on the position of the fluid; (3) surface tension and viscosity of the fluid, both of which may be related to its protein and lipoid content; (4) presence of gas in the pleural cavity, tending to neutralize the effects of the other three factors and completely eliminating the force of capillarity.

Lipschultz (2) reported a case of this type with a lymphoblastoma as the underlying lesion. In his conclusions he mentions essentially the same factors as did Rigler as being responsible for the atypical roentgenographic appearance of the fluid.

Sante (3) has discussed this problem as it is related to subphrenic disease. He states that basal accumulations of fluid frequently occur as a result of subdiaphragmatic inflammatory lesions.

Grier (4) has reported on pyothorax localized in the basal area by adhesions forming a closed space in that region.

Yater and Rodis (5) also reported on fluid accumulation simulating elevation of the diaphragm.

CASE REPORTS

CASE 1: J. W. gave a four-year history of intermittent pleurisy in the left side of the chest. On his admission to the hospital the findings were typical of nasopharyngitis and the chest roentgenogram was entirely negative. One week later he had left lower chest pain and the temperature rose to 100°. A chest roentgenogram now showed what was thought to be an elevation of the left hemidiaphragm. On subsequent films it was noted that a wide zone of density separated the stomach bubble from the base of the lung and a diagnosis of left basal effusion was made. This was confirmed by a left thoracentesis, which yielded a transudate type of fluid. The situation is illustrated in Figure 1, made from another case. Following the thoracentesis, the effusion assumed the usual appearance of intrapleural fluid as seen on the posterior-anterior roentgenogram. The illusion of elevated left hemidiaphragm no longer existed.

Comment: This case illustrates two important features of effusions of this type. First, it demonstrates the value of the stomach bubble as a diagnostic aid when the process is on the left. A solid density practically equal to that of the liver separates the base of the lung from the gas bubble, while ordinarily the two are separated only by the thickness of the diaphragm. Second, it is shown that a localized accumulation may change into an ordinary effusion either spontaneously or following a pleural tap.

CASE 2: W. F. entered the hospital with low-grade fever, cough, and pain in the left hemithorax. Physical examination was negative except for a slight limitation of inspiratory excursion on the left.

On the admission roentgenogram of the chest there was a suggestion of an early pleuritis at the left base. A film and a fluoroscopic examination done eighteen days later showed an apparent elevation of the left hemidiaphragm; there was only slight respiratory motion on this side. A thick heavy shadow separated the apparent dome of the diaphragm from the stomach bubble, indicat-

[1] Accepted for publication in May 1947.

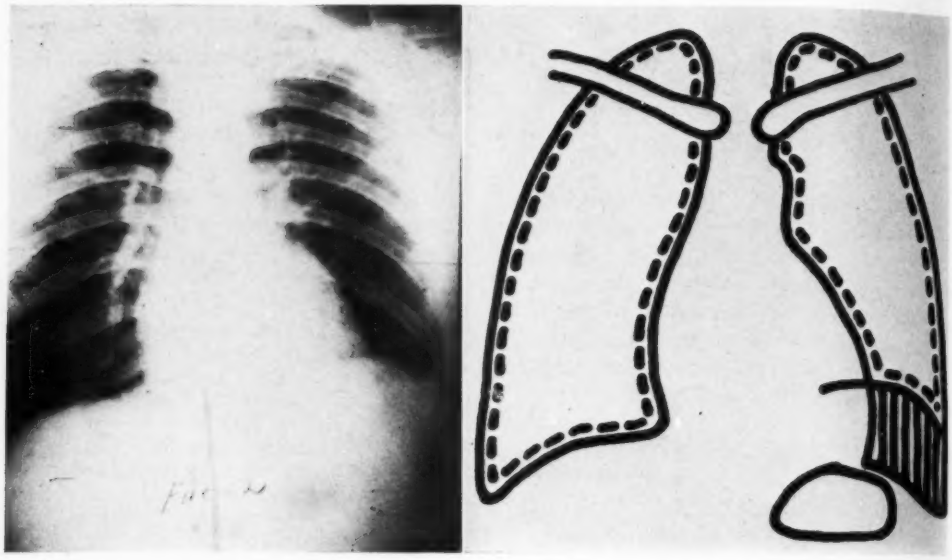


Fig. 1. Apparent elevation of the left hemidiaphragm. Note, however, that there is a thick layer of density separating the stomach from the left lung base. In the diagram, the cross-hatching represents the fluid collection.

ing the presence of a left basal effusion. Figure 1 was made from this case.

Comment: This case again illustrates the usefulness of the stomach bubble in diagnosis when the involvement is on the left side. In this instance the bubble was accentuated by giving the patient two bottles of carbonated drink immediately before fluoroscopy. This simple procedure clearly showed the broad density between the lung base and the stomach bubble.

CASE 3: P. C. F. was first seen in the orthopedic clinic complaining of pain in the right shoulder. No involvement of the shoulder girdle was found on clinical or roentgen examination and, because of a slight temperature elevation, the patient was admitted to the hospital with a diagnosis of upper respiratory infection. On physical examination a limitation of respiratory excursion in the right lower thoracic region and some dullness at the right base were the only positive findings.

Because of the possibility of the shoulder pain being a referred chest pain, a chest roentgenogram was made. This showed an apparent elevation of the right diaphragm, and the possibility of a subphrenic, intrahepatic abscess was entertained. Stool examinations for amebae were done with negative results. Subsequently a thoracentesis with removal of fluid and injection of air gave much better visualization and showed the diaphragm to be at normal level. Figure 2 illustrates the findings in right-sided basal effusion, simulating elevated diaphragm.

Comment: This case is probably the most interesting and instructive of the five being presented. It simulated an obscure subphrenic inflammatory process, either intra- or extrahepatic. The multiple loculations of fluid which eventually developed are ample evidence of the presence of extensive fibrinous adhesions of pleural surfaces. A small amount of air injected into the peritoneal cavity is very helpful in identifying the nature of such a condition early and conclusively and in this case would have ruled out subphrenic disease.

CASE 4: J. M., a soldier, sustained a gunshot wound of the upper abdomen which resulted in a suppurative pericarditis. Concurrently with the development of the pericardial abscess, it became obvious that bilateral pleural effusions were developing. Subsequent roentgenograms showed the usual picture of pleural effusion on the left, but on the right the appearance was that of an elevated diaphragm. A pleural tap on this side, however, yielded a transudate type of fluid. In the course of this tap the needle apparently traversed the diaphragm and a small amount of air was inadvertently injected into the peritoneal cavity. This air outlined the under surface of the diaphragm and

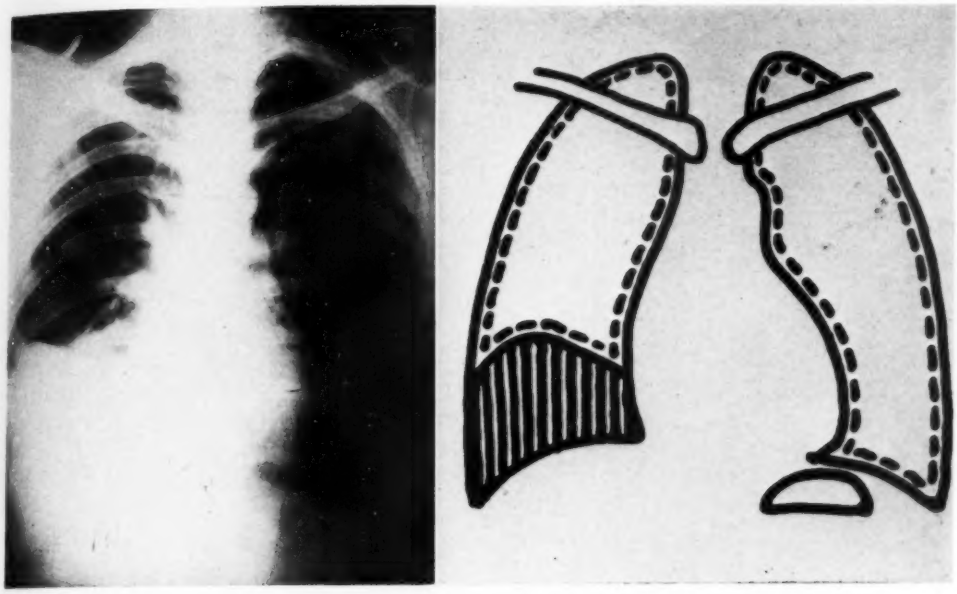


Fig. 2. Right basal effusion simulating elevation of the right hemidiaphragm. Hepatic abscess was suspected. In the diagram, the cross-hatching represents the fluid collection.

showed the thick layer of fluid between the lung base and the upper diaphragmatic surface. The film reproduced poorly and is not included in the illustrations.

Comment: The accidental injection of air under the diaphragm in this case gave support to the idea that a small pneumoperitoneum may be a useful procedure in obscure conditions which appear to involve the right hemidiaphragm.

CASE 5: E. P. was readmitted to the hospital for irradiation of a neoplasm in the breast and anterior axillary fold, with diffuse involvement in the infraclavicular portion of the left chest wall. This irradiation was carried out as a palliative procedure.

Four months later the patient returned with a hard, nodular recurrence at the left sternal margin in the chest wall. At this time postero-anterior, lateral, right and left lateral decubitus chest films were obtained. These showed apparent elevation of the left diaphragm, but there was a wide zone of density between the apparent dome of the diaphragm and the stomach bubble. This was evident both in the postero-anterior and in the lateral projection. The lateral decubitus films show a spilling of fluid out of the basal pleural space, thus dispelling the illusion of an elevation of the left hemidiaphragm. See Figures 3–6.

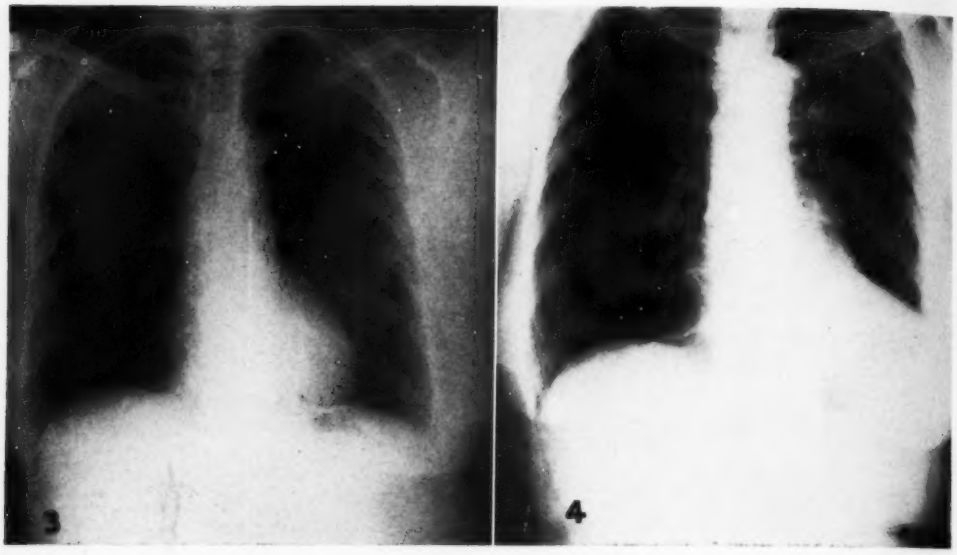
Comment: This case illustrates another etiologic agent in the occurrence of basal effusion simulating elevation of the diaphragm. In addition, it demonstrates the value of lateral decubitus films in identifying the nature of this condition.

DISCUSSION

Experience with the cases presented suggests two points for consideration: first, the matter of differential diagnosis, which has been a real problem in these cases during the early phase; second, consideration of the mechanisms which are responsible for the atypical accumulation of fluid in the pleural space.

Differential Diagnosis: The occurrence of a collection of fluid between the basal surface of the lung and the superior surface of the diaphragm yields a roentgenographic appearance which must be distinguished from subphrenic disease (inflammatory or neoplastic), paralysis of the diaphragm, atelectasis, eventration of the diaphragm, hernia of the diaphragm, intrapleural or intrapulmonary neoplastic disease.

The most difficult problem is the elimina-



Figs. 3 and 4. Case 5. The chest roentgenogram reproduced in Fig. 3 was made prior to the onset of a left basal effusion secondary to involvement of the pleura by a breast carcinoma. Note the close approximation of the stomach bubble to the base of the lung.

Fig. 4, made after the onset of effusion, is suggestive of an elevated left hemidiaphragm. Note, however, the wide zone of density between the apparent level of the diaphragm and the stomach bubble, showing the presence of fluid at the left base.

tion of subphrenic disease producing a progressive elevation of the diaphragm. These patients are likely to have obscure fever and vague symptoms which are of little help in localization of the disease process. The physical examination yields no definite information, since the signs of the two conditions may be identical. This problem arose in Case 3 in which a subphrenic abscess was strongly suspected. A needle was inserted low in the posterior thorax with the idea of passing it through the diaphragm in the costophrenic angle area and entering the abscess. A transudate type of pleural fluid was obtained rather than the expected suppurative material. This occurrence, in view of our recent experience with basal fluid accumulations, led to the correct diagnosis. On the second thoracentesis enough air was injected into the pleural space so that the diaphragm could be clearly outlined roentgenographically. It was then clear that there was no elevation or abnormality of the diaphragm. An earlier and more accurate diagnosis could have been made by means of a small artificial pneumoperitoneum.

As little as 50 c.c. of air injected in the usual manner for pneumoperitoneum serves the double purpose of eliminating the possibility of subphrenic disease and of outlining the under surface of the diaphragm, thus showing the fluid between it and the lung base. Sante (3) has attested to the harmlessness of this procedure even when infection is present in the subphrenic space. The usefulness of pneumoperitoneum was accidentally illustrated, also, in Case 4. During the course of a low pleural tap the diaphragm was evidently penetrated by the needle and a small amount of air was inadvertently injected into the peritoneal cavity. A subsequent roentgenogram of the chest showed a small crescent of air under the right diaphragm, separated by a thick layer of fluid from the base of the right lung. When the involvement is on the left side, the presence of the stomach bubble and the absence of the liver shadow make this procedure less profitable.

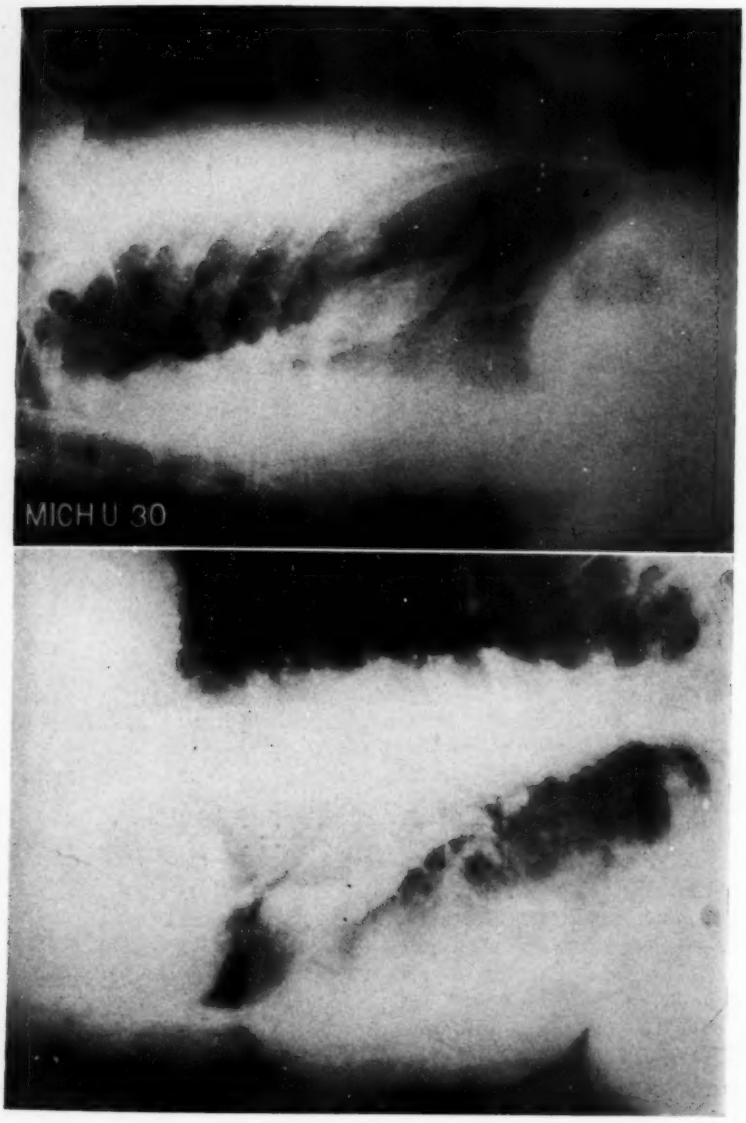


Fig. 5. Case 5. Right and left lateral decubitus roentgenograms. These decubitus films show the level of the left hemidiaphragm to be normal, and the layer of density between the stomach bubble and the left lung base is considerably reduced. In this position some of the fluid has spilled out of the basal pleural space.

A lateral decubitus film will often establish the diagnosis of atypical pleural fluid accumulation and rule out subphrenic disease (Fig. 5). When extensive plastic adhesions are responsible for the retention of fluid at the base, this maneuver may not meet with success. It is believed that this situation is sometimes the main factor in this type of effusion.

Fluoroscopy is of limited value as a differential procedure, since limitation of excursion and elevation of the diaphragm may appear to exist both in basal effusion and in subphrenic abscess.

Fig. 6. Case 5. Upright lateral chest roentgenogram. Here again the layer of fluid between the lung base and the stomach bubble is clearly demonstrated.

Hemiparalysis of the diaphragm is the next most difficult condition to differentiate from atypical basal fluid accumulation. The single roentgenogram may be of no value unless the involvement is on the left side. When the left side is involved in a paralysis, the stomach and/or the splenic flexure of the colon may contain gas. The gas-containing viscus will rise with the elevation of the diaphragm and only the thickness of the latter will separate it from the lung base. In the presence of left basal effusion, these gas-containing structures will be separated by a wide zone of density from the base of the lung, representing the layer of basal fluid (Fig. 1). Naturally, these criteria are valid only in films made in the upright position.

In the event of a hemiparalysis involving the right diaphragmatic leaf, there is no contrasting gas shadow to outline the layer of fluid. Only the liver density is present and this does not contrast with the density of any fluid. Fluoroscopic examination will not consistently solve the problem, since in each condition there may be marked limitation of motion of the diaphragm. In like manner, if the fluid is firmly retained at the base, there will be no shift in position or change in contour of the fluid when the position of the patient is changed. This problem existed in Case 3 and was finally solved by pleural tap and artificial pneumothorax. Pneumoperitoneum would have quickly settled this question and, at the same time, would have ruled out the other possibility, namely subphrenic disease. Paradoxical movement of the diaphragm is evidence against basal effusion.

Herniation or eventration of the diaphragm may be suggested in these cases, but the associated clinical findings differ, and barium studies of the gastro-intestinal tract will readily rule out these conditions.

Atelectasis may cause an elevation of the diaphragm on the affected side and for this reason it may be confused with basal effusion. The history is usually quite different, since atelectasis is commonly a complication of bronchial neoplasm or develops following abdominal surgery. In either case the presence of the atelectatic lung plus other associated signs of increased negative intrapleural pressure are helpful. Physical findings may be similar in the two conditions, *i.e.*, limitation of respiratory excursion, dullness on percussion, and suppression of breath sounds.

Mechanics: As Rigler (1) has stated, the behavior of fluid within the pleural space is influenced by retractility of lung tissue (elasticity), cohesion between the pleural surfaces and capillarity, surface tension of the fluid, and presence of gas in the pleural space. Of these factors, the one which seems most altered in the presence of basal fluid is retractility of the lung.

Under normal conditions, as fluid enters the pleural space, all of the free portions of the lung tend to collapse to an equal degree. The force of gravity causes the greater part of the fluid to accumulate at the base, thinning out in the axillary line. The negative pressure resulting from retractility of the lung is the force which opposes gravity and "draws" the fluid upward. Without this force, the fluid would assume a "level." In the presence of basal effusion, the major factor accounting for the atypical distribution is believed

to be any situation which opposes the normal retractile tendency of the major lateral, anterior, and posterior surfaces of the lung. In the presence of such restraining factors, only the basal surface is free to retract and this action draws the fluid upward into the base of the lung in the typical cupola shape which is illustrated in the cases presented. The restraining factor most likely to exist is that of varying degrees of adherence of visceral to parietal pleura. Emphysema, pulmonary fibrosis, and consolidation affect retractility of the lung and might influence distribution of pleural fluid.

The presence of adhesions is believed to be the factor of major importance. It is to be emphasized that neoplastic involvment of the pleura may be responsible for this situation, as is illustrated by Case 5. In the cases presented, there was evidence of pleural irritation for a considerable time prior to the appearance of fluid. This interval was sufficient to allow fibrinoplastic adhesions to develop and to become an important factor in the localization of the fluid. At times the adherence of the pleural surfaces may be complete enough to convert the basal pleural sinus into an actual closed space. It is probably not necessary for the plastic process to be thus complete, since only partial adherence will restrain the retractile tendency of the lung and alter the factor of capillarity. These changes result in alteration of the contour of the upper margin of the fluid from that usually seen to that which we have described as "basal."

SUMMARY AND CONCLUSIONS

1. Five cases are presented in which fluid accumulation at the lung base closely simulated elevation of the diaphragm. Two involved the right pleural space and three the left.

2. Fluoroscopy, lateral decubitus roentgenograms, pleural tap, demonstration of the stomach bubble, which may be accentuated by giving the patient a carbonated drink prior to examination, and pneumoperitoneum are suggested as useful procedures in differential diagnosis.

3. Physical factors leading to the production of basal fluid accumulations are discussed. The factor of fibrinoplastic adherence of visceral and parietal layers of the pleura is believed to be of major importance.

NOTE: Thanks are due to Dr. Fred J. Hodges, Department of Roentgenology, University of Michigan Hospital, for his advice on the preparation of this paper, and to Dr. Herbert Zatskin of that institution for his drawings.

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SUMARIO

Acumulaciones de Líquido en la Base del Pulmón que Simulan Elevación del Diafragma

Preséntanse cinco casos en los que la acumulación de líquido en la base del pulmón simuló sobremanera elevación del diafragma. En dos estaba afectado el espacio pleural derecho y en tres el izquierdo.

Como procedimientos útiles para el diagnóstico diferencial sugiérense la roentgenoscopia, las radiografías en decúbito lateral, la pleurocéntesis, el hallazgo de la burbuja gástrica, que puede acentuarase administrando al enfermo una bebida gaseosa antes del examen, y el neumoperitoneo.

Discútense los factores físicos que conducen a la acumulación de líquido en las bases de los pulmones, concediéndose importancia primordial a la adherencia fibrinoplástica de las capas visceral y parietal de la pleura.

Influence of Pharmacological Agents on Effects of Irradiation[1]

FRIEDRICH ELLINGER, M.D.

Research Associate in Radiology, Long Island College of Medicine

EVER SINCE THE pioneer days of radiation therapy attempts have been made to influence the effects of irradiation by physical and chemical means in order to bring the desirable actions into the foreground and to eliminate or moderate the undesirable side effects. Our knowledge of the influence of physical procedures in this field, as, for example, the use of scattering media or the effects of temperature, is supported by a considerable number of careful experimental studies. In contrast, the many suggestions for the use of chemicals, hormones, and vitamins for influencing local or general effects of irradiation are based on a relatively small number of experimental studies. The majority of these suggestions depend on clinical observations, the results of which are frequently inconclusive and misleading. This is particularly true of the suggestions made for the treatment of the general intoxication of the irradiated body, clinically known as radiation sickness.

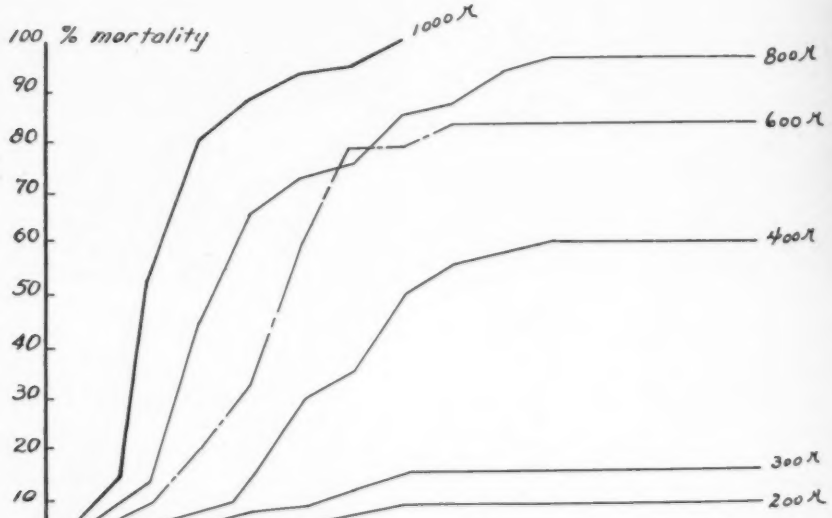

Fig. 1. Lethal dose curves for mice. With increase of the x-ray dose from 200 to 1000 r/air the mortality rate increases from 10 to 100 per cent.

Radiation sickness represents one of the major obstacles in radiation therapy. It is particularly prone to develop if and when the treatment plan requires the exposure of large areas of the body, as in widespread cancers and lymphoblastomata. Severe reactions which make effective dosage impossible are frequently encountered.

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[1] From the Laboratory for Experimental Radiation Therapy, Long Island College of Medicine, Brooklyn, N. Y. Presented at the Thirty-second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–6, 1946.

Supported by grants from the John and Mary R. Markle Foundation, New York, and the Schering Corporation, Bloomfield, N. J.

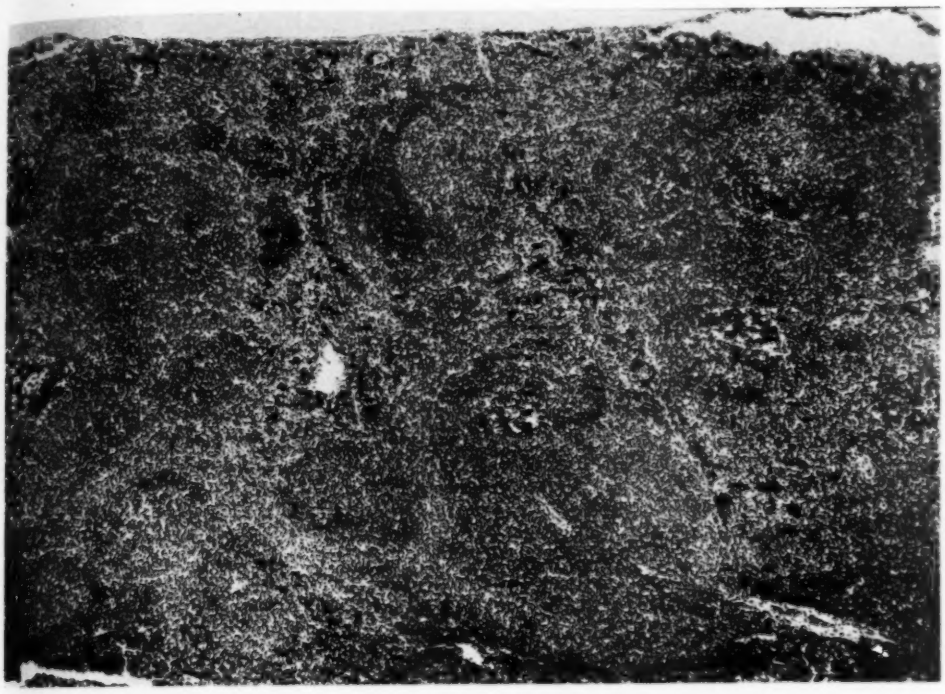

Fig. 2. Normal spleen of a mouse, showing distinctly outlined malpighian bodies.

The most diverse plans for the management of radiation sickness have been suggested. As the British radiologist, Dr. Smithers, aptly put it, "the list of remedies recommended for x-ray sickness is noteworthy more for its length than for any benefit it has provided for sufferers from this distressing complaint (1)." As is usual in the history of therapeusis, a long list of remedies is the result of a lack of clear understanding of the condition under treatment or of proper methods for the evaluation of therapeutic measures to be used. In the case of radiation sickness both factors have contributed to the unsatisfactory state of affairs.

Research work of recent years has contributed considerably to the clarification of the etiology of radiation sickness. The accumulated evidence indicates that in all probability histamine-like substances, if not histamine itself, are responsible for the symptoms of radiation sickness and the various metabolic changes produced within the irradiated body (2). Data obtained during our previous studies on the lethal effect of x-rays seem to offer the foundation for an experimental evaluation of chemicals, hormones, and vitamins suggested for the treatment of radiation effects.

We have been able to demonstrate a graded effect of x-rays in total body irradiation in various animal species, namely goldfish, mice, and guinea-pigs (3, 4). For each of these three species it is possible to establish doses which kill all animals within fourteen days (absolute lethal dose, ALD, and other doses killing a certain percentage of animals only (50 per cent lethal dose, LD 50, etc.). We have also been able to demonstrate the consistency of the lethal effect (4). This phenomenon appears, therefore, suitable for quantitative studies.

Autopsies of the irradiated animals revealed that the graded effect of x-rays on mortality is accompanied by quantitative effects on the spleen (4) and liver (6).

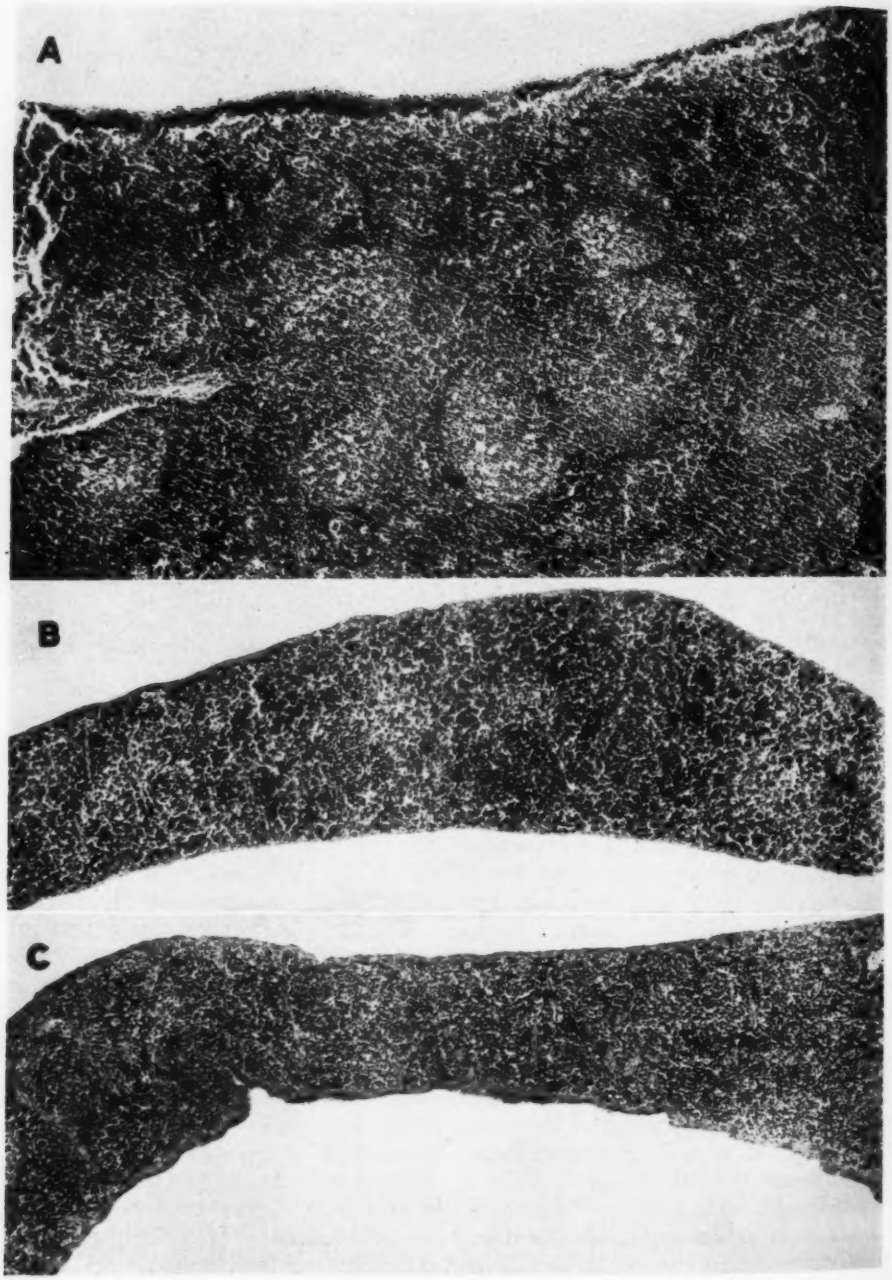

Fig. 3. Graded effect of x-rays on the spleen of the mouse. A. Grade 2. B. Grade 3. C. Grade 4. For detailed description see text.

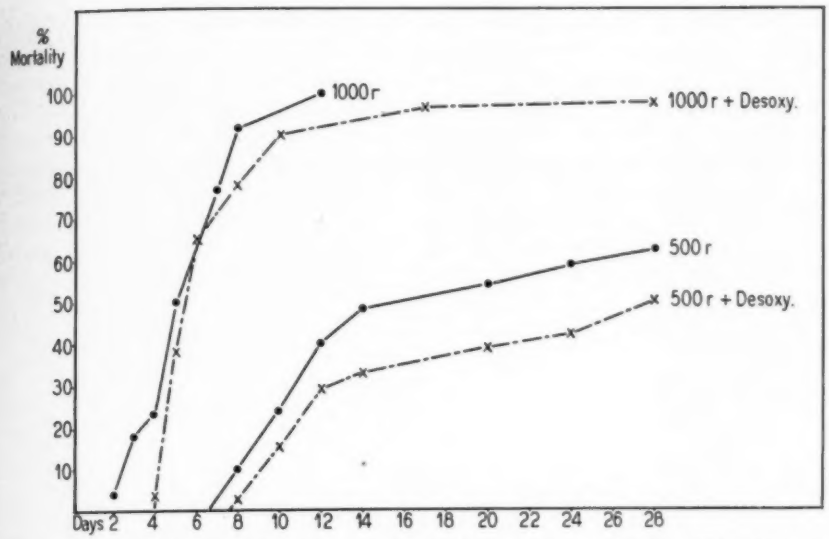

Fig. 4. Influence of desoxycorticosterone on the lethal effect of doses of 1,000 and 500 r/air. A definite reduction of mortality rate takes place in both groups.

For quantitative analysis, we have applied the following arbitrary grading:

A. *Spleen*

0	No change.
+	Slight changes without alteration of the distinct outline of the malpighian bodies.
++	Diminution in the number of white elements combined with disappearance of the distinct outline of the malpighian bodies.
+++	Only remnants of malpighian bodies are left.
++++	Only traces of malpighian bodies are left or the entire spleen is changed into a small strip of fibrous tissue.

B. *Liver:* As previously demonstrated, there is an accumulation of sudanophile fat in irradiated livers for which we have applied the following grading:

0	No sudanophile fat.
+	Traces of fat without any definite arrangement within the liver lobules.
++	Increased amount of sudanophile fat with definite arrangement around the central vessels.
+++	Considerable increase in fat with definite central arrangement.
++++	Fat making up an entire lobule.

The liver changes are of particular interest for the study of the problem of radiation sickness. The accumulated evidence makes it highly probable that the fatty changes are not so much the product of a direct effect of x-rays on the organ, but are largely the result of toxic substances released from other disintegrating tissues injured by the x-rays. This opinion is based on the fact that similar fatty changes in the liver follow extensive irradiation of the skin with doses of ultraviolet rays capable of producing an erythema. Inasmuch as ultraviolet rays penetrate the skin only to a depth of about 0.5 mm., a direct action on the liver is excluded (6).

We shall now present briefly some results of our studies concerning the influence of hormones and vitamins on the effects of irradiation in mice, analyzing them on the basis of three criteria: (1) mortality rate, (2) liver changes, and (3) effects on the spleen. Detailed reports will be given later elsewhere.

Desoxycorticosterone Acetate:[2] The choice of desoxycorticosterone acetate for experimental evaluation was largely determined by the fact that it counteracts certain

[2] Furnished through the courtesy of Dr. E. Henderson of the Schering Corporation, Bloomfield, N. J.

histamine effects (9). Its usefulness for the treatment of radiation sickness seemed, therefore, logical on theoretical grounds. We studied the influence of injections of desoxycorticosterone acetate on the mortality rate produced by doses of 1,000 and 500 r/air, representing the ALD and LD 50, respectively. In both instances a definite decrease in mortality was obtained.

In previous studies of radiation effects we observed that simple dose fractionation decreases the lethal effect of total body irradiation (5). This decrease was found to be of about the same order of magnitude as that produced by desoxycorticosterone treatment of mice receiving the same doses (ALD and LD 50) in a single exposure. We wondered, therefore, whether a combination of fractionation of the x-ray dose with desoxycorticosterone treatment would lead to any further decrease in the mortality rate. That a very considerable decrease was produced by this combination is shown by the following figures. While the over-all mortality rate for a dose of 500 r/air in a single exposure was 61 per cent and that for 500 r fractionated amounted to 48 per cent within twenty-eight days, the mortality rate in the same period of time for animals receiving fractional irradiation and desoxycorticosterone was reduced to 37 per cent.

Autopsies of the irradiated and desoxycorticosterone-treated animals revealed a striking reduction of the accumulation of sudanophile fat produced by the various doses of x-rays used in these experiments (7). No striking differences were observed in the changes in the spleen with any of the doses employed.

The data presented concerning the action of desoxycorticosterone are believed to be an example of the establishment of a sound pharmacological basis for the use of a substance in the treatment of radiation sickness.

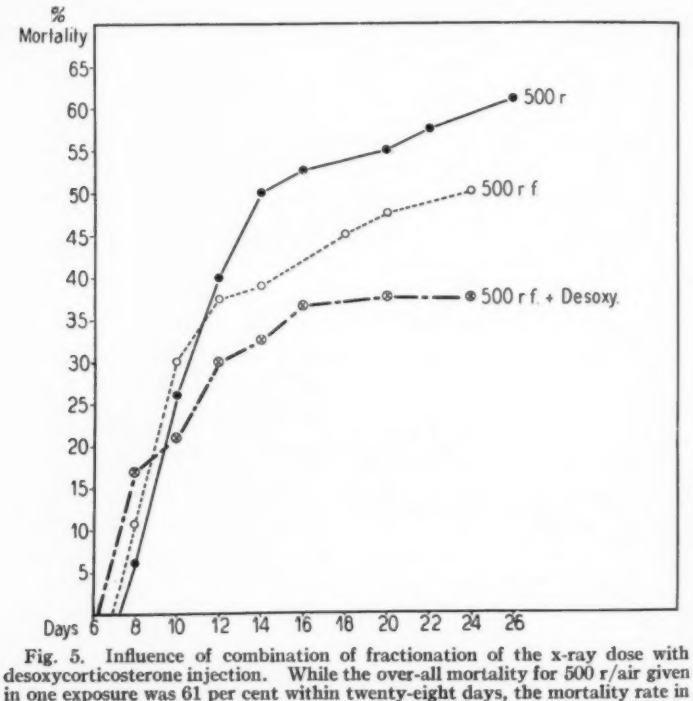

Fig. 5. Influence of combination of fractionation of the x-ray dose with desoxycorticosterone injection. While the over-all mortality for 500 r/air given in one exposure was 61 per cent within twenty-eight days, the mortality rate in the group treated by fractionated dosage and desoxycorticosterone was reduced to 37 per cent for the same period.

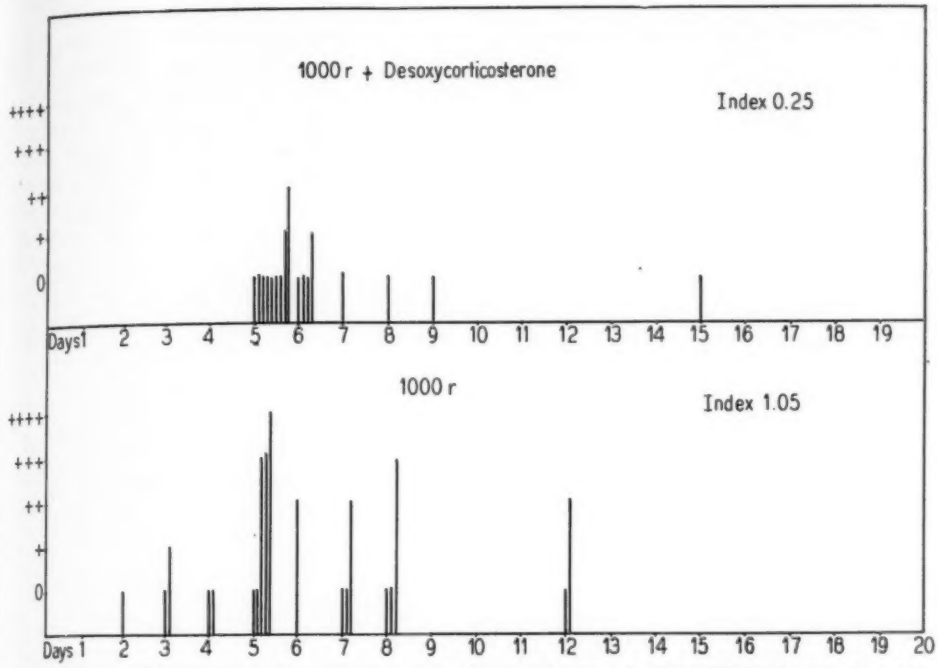

Fig. 6. Influence of desoxycorticosterone treatment on the accumulation of sudanophile fat in animals receiving 1000 r/air. Each column in these charts represents the findings in one liver.

Pregnenolone:[3] Investigation of pregnenolone was prompted by the desire to determine whether or not the favorable action of desoxycorticosterone was a property inherent in the chemical family of steroids or specific for the particular compound. Furthermore, a study of the effect of pregnenolone appeared interesting in view of the report of Treadwell, Gardener and Lawrence (8) that injections of progynon B (estradiol benzoate) prior to irradiation decreased the lethal effect in mice.

Our studies with pregnenolone revealed no decrease in the mortality rate produced by LD 50. Autopsies showed an increase in the accumulation of sudanophile fat in the livers of the irradiated and pregnenolone-treated animals.

The difference in the influence of pregnenolone and desoxycorticosterone on the effects of irradiation are very interesting. As already mentioned, desoxycorticosterone is known to counteract histamine effects. The fact that desoxycorticosterone reduces the mortality rate and liver changes in irradiated animals, while the chemically related pregnenolone does not, seems to support the histamine hypothesis of the general effects of irradiation. Thus, the use of desoxycorticosterone in radiation sickness would represent an etiologic treatment.

This example indicates that the analysis of the effects of irradiation by pharmacological means offers an important method of broadening our knowledge of the mechanism of its action.

Vitamins: The use of vitamins has been repeatedly suggested for the treatment of radiation sickness. The various components of the B-complex have been used with greater or less success. Recently the use of vitamin C for combating leukopenia has been proposed (1, 10–12).

We are presenting here a preliminary report of some of our observations concerning the influence of vitamin B com-

[3] Furnished through the courtesy of Dr. E. Henderson of the Schering Corporation, Bloomfield, N. J.

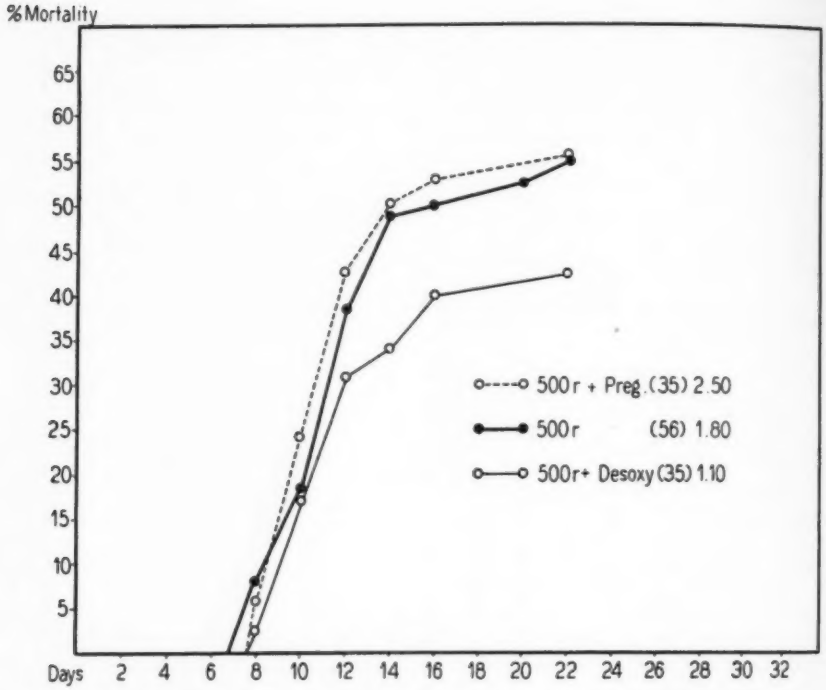

Fig. 7. Effect of pregnenolone on the lethal effect of 500 r/air. For comparison, the effect of desoxycorticosterone on the lethal effect of this dose is inserted. While desoxycorticosterone decreases the mortality, pregnenolone does not produce such an effect.

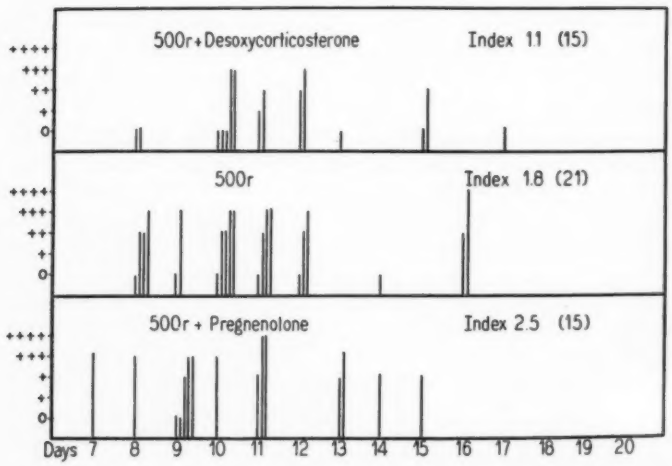

Fig. 8. Effect of pregnenolone on the accumulation of sudanophile fat produced by a dose of 500 r/air. For comparison the effect of desoxycorticosterone is included. While desoxycorticosterone reduces the sudanophile fat content in a striking manner, administration of pregnenolone increases the fat content.

plex and vitamin C on the changes in the liver and spleen induced by irradiation of mice. Though our series is relatively small, a definite reduction in the accumulation of sudanophile fat in the series of animals receiving 500 r/air (LD 50) and vitamins could be observed. While the "fat index" (*i.e.*, the arithmetical mean

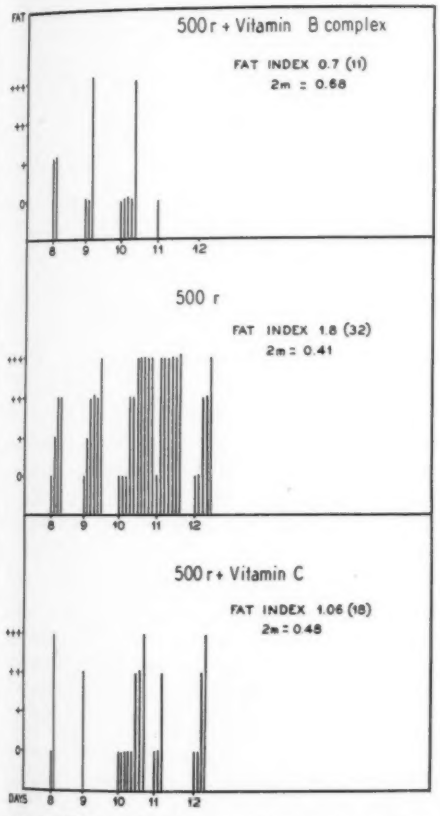

Fig. 9. Effects of various vitamins on the accumulation of sudanophile fat produced by 500 r/air. For proper evaluation, twice the average of the mean (2 m) of the "fat indices" is inserted.

of the various arbitrary grades of sudanophile fat) in a group of 32 animals receiving irradiation alone amounted to 1.8, in a group of 11 animals receiving the same radiation dose and daily injections of a vitamin B complex preparation the index was only 0.7. In spite of the small number of observations, these differences are statistically significant (twice the

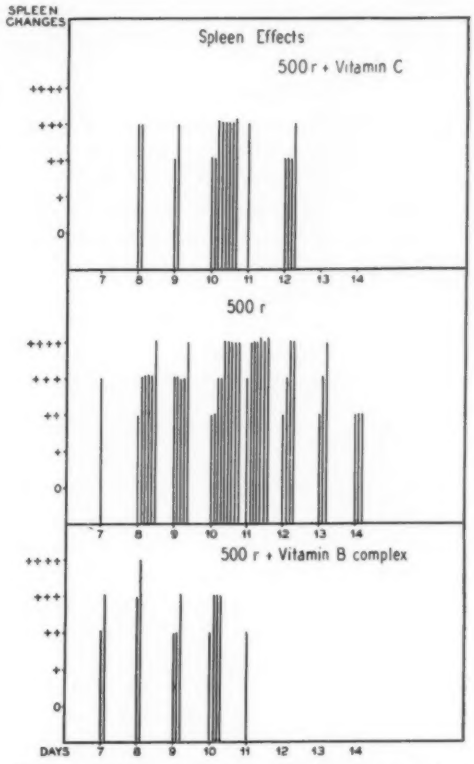

Fig. 10. Effects of various vitamins on the spleen changes produced by 500 r/air. Ordinate values are the arbitrary grades of spleen changes (see text). Each column represents the results in one spleen.

average of the mean (2 m) for the fat indices being 0.41 and 0.68, respectively).[4]

Eighteen animals receiving the same x-ray dose and daily injections of large doses of vitamin C (30 mg. daily for fourteen days) also showed a decrease in the amount of sudanophile fat. The fat index in this group was found to be 1.06. The difference, however, is not statistically significant (2 m = 0.48). It may well be that with a further increase of our material this apparent difference may completely disappear.

No striking difference in the effects

[4] The vitamin B complex preparation was furnished by courtesy of Dr. Marvin R. Thompson of the Marvin R. Thompson Co., Stamford, Conn. The preparation contained B_1 2 mg., B_2 3 mg., niacin and niacinamide 20 mg., in 5 c.c., plus pyridoxine pantothenate, folic acid, choline biotine, inositol. A total of 3.9 c.c. was injected within fourteen days.

produced on the spleens have been found in either group of vitamin-treated animals.

DISCUSSION

In the experimental studies described above, we believe we have demonstrated a simple method for the evaluation of the usefulness of various pharmacologic agents in influencing the effects of irradiation. The criteria selected are easily observable and lend themselves to statistical analysis without difficulty, even with moderate numbers of animals. The importance of statistical analysis of experimental results to prevent erroneous conclusions has been strikingly demonstrated in the case of the study of vitamin effects. The evaluation of suggestions for the treatment of radiation effects, up to now dependent largely upon clinical observation, thus becomes a matter of exact analysis.

Finally, the demonstration of the fact that it is possible by pharmacological means to decrease the mortality rate produced by total body irradiation seems to merit special attention. Total body irradiation has so far been the exclusive concern of the radiologist in the treatment of widespread cancers and allied diseases. The extreme susceptibility of the human body to x-rays administered as total body irradiation has been a definite obstacle in the successful prosecution of a treatment plan where such irradiation seems desirable.

Recently the problem of total body irradiation has acquired a more general importance. The effects of irradiation on the human body by the products of atomic fission have been shown to be of similar nature to those observed by us in animals. The demonstrated possibilities of decreasing the effects of lethal doses of radiations by pharmacological means appears, therefore, to be a matter of the greatest interest for wartime as well as peacetime radiology.

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DISCUSSION

Alfred L. L. Bell, M.D. (Brooklyn, N. Y.): I think that Dr. Ellinger should be complimented upon having presented this rather difficult and complicated subject so well and so concisely. His work has been done, as you may know, in the Laboratory for Experimental Radiation Therapy in Long Island College of Medicine and I have been able to watch it and encourage it throughout the last three or four years. As Dr. Ellinger said, he has demonstrated in previously published works the fact that histamine or histamine-like products are at least a partial cause of the toxic effects of irradiation, if not the only cause, and therefore we have at least a factor by which we can attack this distressing condition.

In the first place, the toxic radiation effects definitely limit the amount of radiation which we can give in cases of metastasis to all parts of the body, and in lymphoblastomata and in the leukemias. It equally affects the amounts of radioactive isotopes which can be used and definitely influences their effectiveness.

Perhaps the knowledge that the formation of large quantities of histamine or histamine-like bodies produces the toxic effects which limit the dosage will help us in using larger dosages and getting better results later, particularly since the work that Dr. Ellinger has done gives us a method by which we can accurately assay the value of these various ma-

terials. The use of desoxycorticosterone is certainly producing striking changes in the mortality rates in his animals and in the changes in the liver. Notable clinical improvement in patients suffering from radiation sickness has also followed the use of desoxycorticosterone. In some instances, however, nausea and vomiting have not been controlled, indicating the possibility of other contributing factors.

It seems to me that this matter is coming up at a most opportune time not only because of the fact that it might help us in increasing radiation dosages and therefore the effectiveness of radiation therapy but because we are going to encounter a great deal more difficulty in the next few years from the administration of radioactive isotopes, both diagnostically and therapeutically, and we are going to see an increasingly large number of accidental exposures to large amounts of radiation through the handling of atomic fission by-products.

Bernard Roswit, M.D. (New York, N. Y.): I am happy to have had the opportunity to hear Dr. Ellinger's paper. He has presented us with a valuable index for accurately recording the effectiveness of therapeutic agents in the control of radiation sickness and in addition has given us a promise of real control of radiation sickness. We have recently undertaken a plan of research in this direction at the Veterans Hospital in New York City under the supervision of Dr. Ellinger. Patients receiving radiation and experiencing radiation sickness have been treated with desoxycorticosterone with some interesting results, which will be shortly published. With this substance we may begin to approach the ideal in the cure of cancer; that is, the destruction of the neoplasm with preservation of the host. It is even conceivable that the population of whole cities may be shielded from the harmful effects of atomic radiation in warfare, by means of this drug.

SUMARIO

Influjo de los Agentes Farmacológicos sobre los Efectos de la Irradiación

En experimentos previamente descritos, demostróse que la irradiación total del cuerpo ejercía un efecto graduado sobre los animales de experimentación, observándose aumento de la mortalidad al acrecentarse la dosis y efecto cuantitativo en el bazo y el hígado. El efecto hepático, consistiendo en acumulación de grasa sudanófila, considérase de importancia en relación con la enfermedad de la radiación.

Las inyecciones de desoxicorticosterona, droga que según se sabe contrarresta ciertos efectos de la histamina, rebajó la mortalidad en los animales irradiados y logró una notable disminución en la acumulación de grasa sudanófila. La pregnenolona, sustancia químicamente afín, no mostró efecto semejante, lo cual parece apoyar la hipótesis que imputa la enfermedad de la radiación a sustancias histamínicas o histaminoideas. La vitamina B compleja aminoró la acumulación de grasa sudanófila, pero los resultados obtenidos con la vitamina C no revistieron importancia estadística. Ninguna de las sustancias estudiadas ejerció efecto alguno sobre las alteraciones esplénicas incidentes a la irradiación.

Los experimentos descritos parecen ofrecer un método sencillo para valuar la efectividad de los agentes farmacológicos en lo tocante a modificar los efectos contraproducentes de la irradiación.

EDITORIAL

Dr. L. Henry Garland

President of the Radiological Society of North America

There are occasions on which a society elects one of its members to its presidency because his skilled and able hand is needed for guidance. There are times when a member is elevated to high office to show him honor. There are occasions when both of these objectives can be achieved simultaneously, realized in the election of Dr. Leo Henry Garland to the Presidency of the Radiological Society of North America.

Dr. Garland was born in Dublin, Ireland, in 1903 and was educated at Belvedere College, Castleknock College, and the University College, Dublin, graduating in 1924 with the degrees of M.B., B.Ch., and B.A.O. His internship was in the Richmond and Rotunda hospitals in Dublin, and he followed this period with one year of graduate study in London.

In late 1925, Dr. Garland came to San Francisco and became a resident in Radiology at Stanford University Hospital, under Dr. W. Edward Chamberlain. On completion of his residency, he became radiologist to St. Mary's Hospital, and occupied that position for two years, after which he set the example for every young radiologist by entering private practice. During these same years, he was appointed Clinical Instructor in Radiology in Stanford University Medical School, on the faculty of which he has remained. He was also named Visiting Radiologist to the Laguna Honda Home, and, a little later, to the San Francisco Hospital. He was certified by the American Board of Radiology in 1934.

Dr. Garland served his adopted country in World War II, his service including assignment overseas, and was honorably discharged with the rank of Commander, M.C., U.S.N. (R).

I confess that I have not taken the time to look up the bibliography of his published work. It is not only extensive, but consists of valuable contributions to the literature of medicine. He was one of the founders of the Pacific Roentgen Society and, since its foundation in 1933, he has been not only the permanent secretary, but the mainspring of that vigorous organization. His life is an active one; he is also Secretary of the California Medical Association, and Vice-President of the American Cancer Society, California Division. He is Associate Clinical Professor of Medicine (Radiology) at Stanford, Attending Radiologist to St. Joseph's Hospital, Visiting Radiologist to the San Francisco City and County Hospital (Stanford Service), Branch Consultant to the Veterans Administration, and Consultant to Letterman General Hospital.

In his odd moments he devotes a surprising amount of time to his lovely and talented wife, Edith Isabel Dohrmann of San Francisco, to whom he was married in 1928, and to their five charming children. He is a color photographer of note, a formidable skier, and a man to be avoided in debate. A brilliant and able man, a man of vision, an ornament to our profession, he will do great credit to our Society.

LOWELL S. GOIN, M.D.

Photo by Kee Coleman

L. HENRY GARLAND, M.D.

President of the Radiological Society of North America

Rheumatoid Spondylitis

Rheumatoid spondylitis, Marie-Strümpell arthritis, spondylitis ossificans ligamentosa, and spondylitis deformans are but a few of the names which are applied to a fairly frequent type of spinal arthritis of obscure origin with rather characteristic roentgen and pathological findings. The earliest change is in the sacroiliac joints, the articular surfaces of which become blurry and irregular in outline. This is generally associated with a mottled increase in the density of the adjacent bones. In most cases there is a rather rapid progress of the disease leading to complete fusion of the joints.

In the spine there occurs an absorption of the cartilage between the articular facets, beginning in the lower lumbar region and progressing upward. This results in a narrowing of these joint spaces and is often associated with irregularity of the articular surfaces. Roentgenographically these changes are best demonstrated in oblique views at approximately 45°. The spinal ligaments become calcified, the involvement again starting in the lower lumbar region and progressing upwards. However, the disease process may be arrested at any stage of involvement so that the entire spine need not necessarily be involved. Furthermore, the disease may be present in the spine and be unrecognizable roentgenographically although easily demonstrable clinically. This is important, as many cases are denied proper treatment as a result of a negative x-ray report.

With involvement of the entire spine, the condition is usually designated as "poker spine" or "bamboo spine." When this stage has been reached, the involved vertebral bodies will show a slowly progressive demineralization. The intervertebral spaces may or may not be narrowed; in most cases there is an absence of disk narrowing. The disease is most frequent in males and the onset is usually in the second or third decade of life.

Roentgen Therapy: As early as 1930 reports began to appear in the literature claiming subjective improvement in rheumatoid spondylitis following roentgen therapy to the involved areas of the spine. Results were especially good in early cases.

It remained for Smith, Boland, Shebasta and Hench in the Army Rheumatism Center, Hot Springs, Arkansas, to give this form of therapy an adequate test, their experience being based on over 1,000 cases. They found roentgen therapy of definite value in the treatment of rheumatoid spondylitis. The immediate effects were the reduction of pain, tenderness and stiffness of the spine; less frequently limitation of motion, restriction of chest expansion, muscle spasm, and the general constitutional condition were favorably influenced.

The frequency with which beneficial results were obtained did not depend on the severity of the disease, but rather on its duration and the degree of advancement of the structural changes. Thus, recently involved regions demonstrated better symptomatic response than did regions where the disease had been present for years. Complete disappearance of all symptoms and physical manifestations rarely occurred.

A total dose of 600 r, as measured in air, is given each area of involvement in divided doses (either three or four treatments), with the following physical factors: 180–200 kv. p.; 0.5 mm. copper plus 1.0 mm. aluminum filtration; target-skin distance 50 cm. In cases of long standing, two or three series of treatments, three or four months apart, are usually necessary before definite improvement is observed.

One word of caution should be noted. Roentgenograms of the spine taken after completion of roentgen therapy show no regression of the lesion or other changes. For this reason it is impossible to estimate how long the beneficial effects will be sustained until long-term studies are pursued under properly controlled conditions.

KENNETH S. DAVIS, M.D.

Presentation of Gold Medals

At the Thirty-third Annual Meeting of the Radiological Society of North America, in Boston, in December 1947, for the first time in more than a decade two gold medals were awarded for conspicuous service to the science of Radiology. The remarks of President O'Brien, who had the honor of making the presentations, reflect the high regard in which the recipients are held by their fellow members in the Society.

By the power invested in me, by unanimous vote of the Board of Directors, it is my privilege and honor to bestow the gold medal of the Radiological Society of North America on two of its members who have rendered unusual service to the science of Radiology.

One was born in Sicily in 1891 and came to the United States at the age of fourteen; was educated in Stuyvesant High School and Columbia University, New York City, and later obtained the degree of D.Sc. from the University of Paris. His interest in radiology began while he was still a student at Columbia, and he started working part time in the laboratories at Memorial Hospital. There it early became his concern to develop a radiological research division, and a beginning of this was made immediately after the First World War. Here his main concern was the relation between physics and the clinical problems of radiation treatment of cancer. He developed instruments and planned experiments for standardization of x-ray and radium dosage and the investigation of biological effects of radiation, which formed the beginnings of the study of radiation biology in America. At the same time that he was working on purely research problems, he was also interested in developing and perfecting new treatment technics. He was early interested in the setting up of international standards of radiation dosage, and also of protection, being a member of the International Standardization Committee from its inception.

Under his guidance, the physics and biophysics laboratories of the Memorial Hospital attained international recognition. In 1943 he went to the College of Physicians and Surgeons of Columbia University to develop a radiological research department there. Very soon thereafter, he joined the Manhattan Project on a part-time basis and throughout the war years and up to the present, he has been almost doing two full-time jobs, one on the project and one in his department. Most of his work on the project is still under security, but it may be said that he had much to do with the setting up of the safety standards and precautions which gave the project such an excellent record.

He is a member of the four radiological organizations of the United States (Radiological Society of North America, the American Roentgen Ray Society, The American Radium Society, and the College of Radiology), and of several physical organizations. His extensive bibliography in radiological and physical journals attests his contributions to knowledge in these fields. In 1939 he gave the Janeway Lecture of the American Radium Society, and in 1945 the Caldwell Lecture of the American Roentgen Ray Society.

He is recognized nationally and internationally as the leading radiological physicist in America. His aid and advice are sought from all sides and freely given.

To you, *Gioacchino Failla*, I present the gold medal of the Radiological Society of North America.

The other recipient was born in Canada, also in 1891, where at Toronto he later received his medical degree. He came to the United States in 1914. In 1916, after an internship of two years at the New York City Hospital, he became assisting attending surgeon at the Memorial Hospital, New York.

Serving as attending surgeon of the head and neck service at the Memorial from 1921 to 1932, he was, as well, Director of Radiation Therapy from 1927 to 1932. It was there he blazed the trail for therapeutic radiology which has been followed so fruitfully, not only in America but in Europe as well.

Modest to a fault, he would only be embarrassed should I enumerate his present positions as attending and consulting surgeon to New York's important hospitals. He is a Diplomate and Trustee of the American Board of Radiology and a member of the four radiological societies of the United States, as well as the British Roentgen Society and the Northern Association of Radiologists of the Scandinavian countries.

His contributions to therapeutic radiology are numerous and authoritative. In 1925–26 he was President of the American Radium Society and in 1937 he gave the Janeway Lecture of that Society. In 1941 he was President of the New York Roentgen Society.

While Dr. Failla planned experiments for standardization of x-ray and radium dosage, his confrere, working with him at the Memorial Hospital, painstakingly applied the knowledge thus gained to the care and cure of cancer clinically. His training in surgery and therapeutic radiology has given him an enviable balance in the treatment of neoplastic disease.

To you, *Douglas Quick*, I present the gold medal of the Radiological Society of North America.

AMERICAN BOARD OF RADIOLOGY

Heretofore the American Board of Radiology has demanded that all candidates admitted to examination should be graduates of an approved Class A medical school. The Board has recently ruled, however, that those who have graduated from foreign and substandard medical schools before 1947 may be admitted to the examination if and when they have complied with the other requirements of the Board. No candidate who graduates from a substandard school (foreign or domestic) after 1947 will be admitted to the examination.

The Board has also ruled that a maximum credit of six months toward the required three years training may be allowed for formal didactic courses in the basic sciences.

Many candidates who have applied for the entire field of Radiology or Roentgenology and who pass the examination in Diagnostic Roentgenology, or possibly in Therapy, ask for a limited certificate in the field in which they have passed, expecting to reapply shortly for re-examination in the other field. This they are entitled to do, but in order to discourage candidates taking partial certificates, the Board has ruled that two years must elapse after a candidate accepts a certificate in one field before he may apply for additional certification.

AMERICAN COLLEGE OF RADIOLOGY POSTGRADUATE COURSE

A Postgraduate Course in Certain Neoplastic and Inflammatory Diseases was conducted Feb. 2 to 6, in Philadelphia, by the American College of Radiology in co-operation with the Philadelphia Roentgen Ray Society. Dr. Barton R. Young, Dr. Eugene P. Pendergrass, Dr. Paul C. Swenson, Dr. W. Edward Chamberlain, and Dr. Bernard P. Widmann acted as chairmen of the sessions.

This course was the third of a series which the Commission on Education of the American College of Radiology plans to offer in various sections of the United States. These courses will be conducted in co-operation with local radiological societies and in conjunction with medical schools where teachers in the various related subjects are available. A course in Chicago is being planned for 1948.

LOS ANGELES RADIOLOGICAL SOCIETY

At a recent meeting of the Los Angeles Radiological Society, which is a Section of the Los Angeles County Medical Association, the following officers were elected for the ensuing year: President, Dr. Roy L. Fielder; Vice-President, Dr. John S. McAtee; Secretary, Dr. Moris Horwitz; Treasurer, Dr. Wilbur Bailey.

ASSOCIACION PUERTORRIQUEÑA DE RADIOLOGIA

The recently organized Puerto Rican Radiological Association has announced the election of the following officers: President, R. A. Blanes, M.D.; Vice-Presidents, Pedro Ramos Casellas, M.D., and Manuel Guzmán, M.D.; Treasurer, José Landrón, M.D.; Secretary, Jesús Rivera Otero, M.D.; Vocals, Guillermo Ruiz Cestero, M.D., and G. Marqués, M.D. The Honorary President of the organization is Dr. Isaac González Martínez. The postal address is Box 3524, Santurce, Puerto Rico.

MIDWEST RADIOLOGIC CONFERENCE

The 1948 Midwest Radiologic Conference was held in Milwaukee, Wis., Feb. 6 and 7, followed by the Annual Conference of Teachers of Radiology in Chicago, Feb. 8. Dr. Robert R. Newell, Professor of Radiology, Stanford University School of Medicine, San Francisco, was the dinner speaker at the Milwaukee meeting on Feb. 6.

AMERICAN ACADEMY OF GENERAL PRACTICE

The American Academy of General Practice, founded in June 1947, to promote progress in the general practice of medicine in much the same way that the specialty societies have promoted progress among specialists, now has a membership representing forty-two states, the District of Columbia, and Hawaii. Mr. Mac F. Cahal, Executive Secretary of the American College of Radiology, is serving as general counsel and acting executive secretary of the Academy. Headquarters are at 20 N. Wacker Drive, Chicago.

In Memoriam

FLOYD DWIGHT RODGERS, M.D.

Word has recently been received of the death of Dr. Floyd Dwight Rodgers, of Columbia, South Carolina, for over twenty-five years a member of the Radiological Society of North America. Dr. Rodgers was born in Lake City, South Carolina, sixty years ago. He was graduated from the Medical College of the State of South Carolina in 1910, and up to the time of World War I was engaged in general practice and public health work. He entered the Army in 1917, served in France, and was honorably discharged with the rank of Major. Upon his return to civilian life, Dr. Rodgers devoted himself to the practice of radiology, being associated with Dr. Robert W. Gibbs until the latter's retirement in 1925. Dr. Rodgers was a diplomate of the

American Board of Radiology and a member of the American College of Radiology.

Book Reviews[1]

TEMAS DE CANCEROLOGIA Y RADIOTERAPIA. VOL. I. BIOLOGÍA—DIAGNÓSTICO—MÉTODOS GENERALES DE TRATAMIENTO. Universidad Nacional de Colombia, Instituto de Radium. Conferencias dictadas en el Curso Libre de Cancerología del año de 1945, bajo la dirección de los Profesores CESAR A. PANTOJA, Director del Instituto, y ALFONZO ESGUERRA GOMEZ, Profesor Titular de Cancerología. Campana Colombiana Contra el Cancer. Editorial Minerva, Ltda., Bogota, 1946. A volume of 675 pages, with 108 figures.

There has been collected, under the direction of Professors Pantoja and Esguerra Gomez a series of lectures on the diagnosis and treatment of cancer, and in particular on radiotherapeutic methods. These lectures were given by numerous distinguished specialists of the Republic of Colombia, in 1945, at the Radium Institute of the National University. The book opens with a lengthy plan presented to the Colombian Government by Professor Claude Regaud, in 1929, for the organization of the Institute of Radium and the fight against cancer in that South American country.

The second part of the book is devoted to the diagnosis of cancer with emphasis on clinical and radiological aspects. Very notable in this chapter are the articles written by Doctor Gonzalo Esguerra Gomez on the radiographic examination of bone and laryngeal tumors, including a discussion of tomography.

The third part is devoted to the presentation of the radiological treatment of cancer. There seems to be here an excessive emphasis on the use of radium, in all its different applications, at the expense of the presentation of roentgen therapy, which is limited to its physical aspects. There is in these pages an interesting presentation of the intravenous administration of radium emanation, by Doctor Alfonso C. Frangella, visiting lecturer from the University of Uruguay, which summarizes the fifteen years experience of that worker with this form of irradiation.

One may argue that it is primarily wrong to discuss radiotherapy of cancer without a commensurate discussion of surgical treatment, that a unilateral approach is educationally pernicious. This book, however, constitutes a very worth-while effort, and it is an index of the interests and capabilities of our Latin-American colleagues in the field of cancer.

[1] Unfortunately, in a recent review of *Cancer: Diagnosis, Treatment, Prognosis*, by Lauren V. Ackerman, M.D., and Juan A. del Regato, M.D., the name of the publisher was omitted. The book is published by C. V. Mosby Co., St. Louis, Mo.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

DISEASES OF THE CHEST: WITH EMPHASIS ON X-RAY DIAGNOSIS: By ELI H. RUBIN, M.D., F.A.C.P., F.C.C.P., Attending Physician, Division of Pulmonary Diseases, Montefiore Hospital and Country Sanatorium, New York; Visiting Physician in Tuberculosis and Physician-in-charge, Chest Clinic, Morrisania City Hospital, New York. A volume of 685 pages, with 355 illustrations (24 plates in color). Philadelphia, W. B. Saunders Co., 1947. Price $14.50.

SELECTED PAPERS FROM THE ROYAL CANCER HOSPITAL (FREE) AND THE CHESTER BEATTY RESEARCH INSTITUTE, London, Vol. IV, 1943–1944, comprising reprints of articles from various journals. A volume of 381 pages.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates. Address: Howard P. Doub, M.D., The Henry Ford Hospital, Detroit 2, Mich.

UNITED STATES

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 607 Medical Arts Bldg., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, Hugh F. Hare, M.D., 605 Commonwealth Ave., Boston 15, Mass.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Harold Dabney Kerr, M.D., Iowa City, Iowa.

AMERICAN COLLEGE OF RADIOLOGY. *Secretary*, Mac F. Cahal, 20 N. Wacker Dr., Chicago 6, Ill.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, U. V. Portmann, M.D., Cleveland Clinic, Cleveland 6, Ohio.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Courtney S. Stickley, M.D., Bell Bldg. Montgomery. Next meeting at the time and place of the Alabama State Medical Association meeting.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and annually at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Sydney F. Thomas, M.D., Palo Alto Clinic, Palo Alto.

LOS ANGELES RADIOLOGICAL SOCIETY (A SECTION OF THE LOS ANGELES COUNTY MEDICAL ASSOCIATION). *Secretary*, Moris Horwitz, M.D., 2009 Wilshire Blvd., Los Angeles 5. Meets second Wednesday of each month at County Society Bldg.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with State Medical Association.

SAN DIEGO ROENTGEN SOCIETY. *Secretary*, R. F. Niehaus, M.D., 1831 Fourth Ave., San Diego. Meets first Wednesday of each month.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Ivan J. Miller, M.D., 2000 Van Ness Ave. Meets monthly on the third Thursday at 7:45 P.M., January to June at Lane Hall, Stanford University Hospital, and July to December at Toland Hall, University of California Hospital.

Colorado

DENVER RADIOLOGICAL CLUB. *Secretary*, Mark S. Donovan, M.D., 306 Majestic Bldg., Denver 2. Meets third Friday of each month, at the Colorado School of Medicine and Hospitals.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Robert M. Lowman, M.D., Grace-New Haven Hospital, Grace Unit, New Haven. Meetings bimonthly, second Thursday.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. A. Beals, M.D., St. Luke's Hospital, Jacksonville. Meets semiannually, in April, preceding the annual meeting of the Florida Medical Society, and in November.

Georgia

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert Drane, M.D., De Renne Apartments, Savannah. Meets in November and at the annual meeting of State Medical Association.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, T. J. Wachowski, M.D., 310 Ellis Ave., Wheaton. Meets at the Palmer House, second Thursday of October, November, January, February, March, and April, at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly as announced.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, John H. Gilmore, M.D., 720 N. Michigan Ave., Chicago 11.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, J. A. Campbell, M.D., Indiana University Hospitals, Indianapolis 7. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*, Arthur W. Erskine, M.D., 326 Higley Building, Cedar Rapids. Meets during annual session of State Medical Society.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney E. Johnson, M.D., 101 W. Chestnut St., Louisville.

LOUISVILLE RADIOLOGICAL SOCIETY, *Secretary-Treasurer*, Everett L. Pirkey, Louisville General Hospital, Louisville 2. Meets second Friday of each month at Louisville General Hospital.

Louisiana

LOUISIANA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Johnson R. Anderson, M.D., No. Louisiana Sanitarium, Shreveport. Meets with State Medical Society.

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday, 7:30 P.M.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary*, Harry A. Miller, 2452 Eutaw Place, Baltimore.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary-Treasurer*, E. R. Witwer, M.D., Harper Hospital, Detroit 1. Meetings first Thursday of each month from October to May, at Wayne County Medical Society club rooms.

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS. *Secretary-Treasurer*, R. B. MacDuff, M.D., 220 Genesee Bank Building, Flint 3.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, C. N. Borman, M.D., 802 Medical Arts Bldg., Minneapolis 2. Regular meetings in the Spring and Fall.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, John W. Walker, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Edwin C. Ernst, M.D., 100 Beaumont Medical Bldg. Meets on fourth Wednesday of each month, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Ralph C. Moore, M.D., Nebraska Methodist Hospital, Omaha 3. Meetings third Wednesday of each month at 6 P.M. in either Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, George Levene, M.D., Massachusetts Memorial Hospitals, Boston, Mass. Meets monthly on third Friday at Boston Medical Library.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary-Treasurer*, Albert C. Johnston, M.D., Elliot Community Hospital, Keene. Meetings quarterly in Concord.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Raphael Pomeranz, M.D., 31 Lincoln Park, Newark 2. Meetings at Atlantic City at time of State Medical Society and midwinter in Newark as called.

New York

ASSOCIATED RADIOLOGISTS OF NEW YORK, INC. *Secretary*, William J. Francis, M.D., East Rockaway, L. I.

BROOKLYN ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Abraham H. Levy, M.D., 1354 Carroll St., Bklyn. 13. Meets fourth Tuesday of every month, October to April.

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday evening each month, October to May, inclusive.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary-Treasurer*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 10. Meetings in January, May, and October.

LONG ISLAND RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

NEW YORK ROENTGEN SOCIETY. *Secretary*, Wm. Snow, M.D., 941 Park Ave., New York 28.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary*, Murray P. George, M.D., 260 Crittenden Blvd., Rochester 7. Meets at Strong Memorial Hospital, third Monday, September through May.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary-Treasurer*, James E. Hemphill, M.D., Professional Bldg., Charlotte 2. Meets in May and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, Charles Heilman, M.D., 1338 Second St., N., Fargo.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Carroll Dundon, M.D., 2065 Adelbert Road, Cleveland 6. Next meeting at annual meeting of the State Medical Association, Cincinnati, March 31, 1948.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Edward T. Kirkendall, M.D., 700 North Park St., Columbus 8.

CINCINNATI RADIOLOGICAL SOCIETY. *Secretary*, Eugene L. Saenger, M.D., 735 Doctors Bldg., Cincinnati 2. Meets last Monday, September toMay.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, George L. Sackett, M.D., 10515 Carnegie Ave., Cleveland 6. Meetings at 6:30 P.M. on fourth Monday, October to April, inclusive.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Peter M. Russo, M.D., 230 Osler Building, Oklahoma City. Meetings three times a year.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Wm. Y. Burton, M.D., 242 Medical Arts Bldg., Portland 5. Meets monthly, on the second Wednesday, at 8:00 P.M., in the library of the University of Oregon Medical School.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4, Wash. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, Calvin L. Stewart, M.D., Jefferson Hospital, Philadelphia 7. Meets first Thursday of each month at 8:00 P.M., from October to May in Thomson Hall, College of Physicians, 21 S. 22d St.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, R. P. Meader, M.D., 4002 Jenkins Arcade, Pittsburgh 22. Meets second Wednesday of each month at 6:30 P.M., October to June.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maurice D. Frazer, M.D., Lincoln Clinic, Lincoln, Nebr.

South Carolina

SOUTH CAROLINA X-RAY SOCIETY. *Secretary-Treasurer*, Robert B. Taft, M.D., 103 Rutledge Ave., Charleston 16.

Tennessee

MEMPHIS ROENTGEN CLUB. Meetings second Tuesday of each month at University Center.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frére, M.D., 707 Walnut St., Chattanooga. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, X. R. Hyde, M.D., Medical Arts Bldg., Fort Worth 2. Meetings on third Monday of each month in Dallas in the odd months and in Fort Worth in the even months.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth 4.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, M. Lowry Allen, M.D., Judge Bldg., Salt Lake City 1. Meets third Wednesday, January, March, May, September, November.

UNIVERSITY OF UTAH RADIOLOGICAL CONFERENCE. *Secretary*, Henry H. Lerner, M.D. Meets first and third Thursdays, September to June, inclusive, at Salt Lake County General Hospital.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., Norfolk General Hospital, Norfolk 7.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Homer V. Hartzell, M.D., 310 Stimson Bldg., Seattle 1. Meetings fourth Monday October through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, A. Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee 2. Meets monthly on second Monday at the University Club.

RADIOLOGICAL SECTION OF THE WISCONSIN STATE MEDICAL SOCIETY. *Secretary*, S. R. Beatty, M.D., 185 Hazel St., Oshkosh. Two-day meeting in May and one day at annual meeting of State Medical Society in September.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursdays 4 to 5 P.M., September to May, inclusive, Room 301, Service Memorial Institute, 426 N. Charter St., Madison 6.

Puerto Rico

ASOCIACION PUERTORRIQUEÑA DE RADIOLOGIA.—*Secretary*, Jesus Rivera Otero, M.D., Box 3524, Santurce, Puerto Rico.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, E. M. Crawford, M.D., 2100 Marlowe Ave., Montreal 28, Quebec. Meetings in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES. *General Secretary*, Origéne Dufresne, M.D., Institut du Radium, Montreal. Meets on third Saturday of each month.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPIA DE CUBA. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPIA. *General Secretary*, Dr. Dionisio Pérez Cosío, Marsella 11, México, D. F. Meetings first Monday of each month.

ABSTRACTS OF CURRENT LITERATURE

ROENTGEN DIAGNOSIS

The Head and Neck

The Chest

The Digestive System

The Musculoskeletal System

Gynecology and Obstetrics

The Genito-Urinary System

The Blood Vessels

ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Second-Day Encephalography, with Particular Reference to the Size of the Ventricles. Richard Schatzki, Donald H. Baxter, and Charles E. Troland. New England J. Med. **236:** 419–428, March 20, 1947.

This is a study of 60 patients in whom encephalography was repeated on the second day after ventricular filling with air. In 38 per cent, the ventricles were found to be larger on the second day than on the first examination. All of the patients with pronounced second-day enlargement of the ventricles had had head injuries. A porencephalic cyst was also better demonstrated by second-day examination, and often better filling of both ventricles was obtained on the second day.

The ventricular enlargement on the second day is definite but difficult to explain. It is possible that gas trapped in the extraventricular region may pass upward into the ventricles, thus expanding them, or disappearance of the gas in the subarachnoid space may permit their dilatation. Thirdly, some abnormality in the gaseous interchange may be at work, or, finally, a difference of intracranial pressure on the two days or temperature alteration in the gas volume may account for the difference in size.

The author raises the question whether the first-day or second-day examination represents the true ventricular size. The sudden withdrawal of ventricular fluid may result in a definite increase in size. This is supported by the finding that after the second-day no further increase is demonstrable. It has been found that patients with repeated brain trauma, with signs of considerable brain damage, may show a normal encephalogram the first day but dilatation of the ventricles on the second day.

First-day examination may represent the normal size of the ventricles, but the irritation of the air may cause increased secretion, with ventricular dilatation. This is supported by the finding of second-day enlargement when considerable amounts of air have been introduced into the ventricular system. It is suggested that measurements of the spinal fluid pressure be made at the time of encephalography and again the following day. This might lead to a better explanation of some of the changes seen.

It is the belief of the author that second-day examinations represent the normal or resting size of the ventricles, but further clinical and experimental studies appear necessary.

It is suggested that routine studies of second-day ventriculograms be made on all patients, and particularly in cases of old head injuries or atrophy of the brain. It has been frequently noted that second-day examination will clearly define the changes only suspected on the first-day examination.

JOHN B. MCANENY, M.D.

Roentgen Manifestations in the Skull of Metastatic Carotid Body Tumor (Paraganglioma), of Meningioma and of Mucocele. Report of Three Unusual Cases. Eugene P. Pendergrass and David Kirsh. Am. J. Roentgenol. **57:** 417–428, April 1947.

The clinical, roentgenologic, and pathologic findings in three unusual cases, all of which showed unilateral exophthalmos and osteolytic skull lesions, are reported.

A white male, aged 24, was seen for a progressive swelling over the left eye of six months' duration. A non-pulsatile mass had been present in the left side of the neck for many years. Roentgen examination showed destruction of the frontal bone, left orbit, and frontal sinus, with evidence of bone proliferation. A roentgen diagnosis of angiosarcoma was suggested. The lesion showed only slight response to x-ray therapy. Subsequently, removal of the tumor was attempted, but because of hemorrhage only a biopsy was done. At later operations a considerable portion of the tumor was removed. It continued to increase in size, however, and a second series of irradiation was given, again with practically no response. Metastases to the lungs and 4th lumbar vertebra were demonstrated roentgenologically, and there was a pathological fracture of the femur. The patient died about three and one-half years after swelling of the eye first appeared. Postmortem examination showed metastases in the lungs, liver, left parietal bone, several vertebrae, pelvis, right femur, ribs, and sternum. On microscopic examination the tumor was first thought to be an angiosarcoma. Further study, however, indicated it to be a malignant paraganglioma of the carotid body with metastases.

Carotid body tumors have been given a wide variety of names, probably because of the presence within them of vascular, neural, and fibrous tissues. Of 250 cases described, about 20 per cent were locally malignant. Only one instance of distant metastases had been reported previously. Carotid body tumors are apparently quite radioresistant.

The second patient, a white female aged 57, had an exophthalmos of the right eye, which was pushed downward and forward by a huge, bluish, cystic mass in the frontal, parietal, and maxillary regions. The head was greatly deformed and asymmetrical. Roentgen examination showed erosion of the lateral wall of the orbit, the adjacent frontal bone, and the sphenoid. Perpendicular striations of bone were visible. Osteogenic sarcoma and angiosarcoma were the diagnoses given most consideration. Autopsy showed malignant fibroblastic meningioma.

The third patient, a white female aged 74, had a slowly growing mass over the left eye, present for about fifteen years. It had appeared following a fall. In the last six months the mass had enlarged rapidly, pushing the eye outward and downward. It was not painful. It showed considerable variation in character from time to time. Spontaneous rupture occurred, with drainage of foul-smelling brown material. A portion of the lesion appeared gangrenous. Roentgenographic examination revealed bone destruction involving the frontal bone, orbits, frontal, ethmoid, and maxillary sinuses. Because of the well defined, dense periphery of the bone erosion, a diagnosis of mucocele was suggested. This diagnosis was confirmed surgically.

H. H. WRIGHT, M.D.

Roentgen Examination of the Sphenoidal Fissures. George J. Baylin and Herbert D. Kerman. South M. J. **40:** 281–289, April 1947.

The authors describe in some detail the significant changes in and about the sphenoidal fissures that are

important in the diagnosis and localization of intracranial and intraorbital lesions. The regional anatomy is described and the roentgen technic discussed. The fissures are classified into six groups according to their size, shape, and symmetry (Kornblum and Kennedy: Am. J. Roentgenol. **47:** 845, 1942. Abst. in Radiology **41:** 84, 1943). Line drawings illustrating the 6 anatomic groups are reproduced.

Radiologically the fissures should be closely examined for size, shape and symmetry; clarity of the borders; density of the surrounding bone on both sides; evidence of decalcification; evidence of hyperostosis; bone destruction; fractures; abnormal calcifications; abnormal position; soft-tissue density.

A list of lesions affecting the sphenoidal fissure is given. These are: meningiomas, metastatic tumors, undiagnosed orbital tumors, lymphomatous tumors of the orbit, hemangiomas, arteriovenous aneurysms, craniopharyngiomas, fractures of the sphenoid bone and ridge, osteomas, mucoceles, optic nerve tumors, pituitary tumors, osteomyelitis, and some other unclassified brain tumors. A number of roentgenograms are reproduced illustrating the changes described by the authors. In a considerable number of cases the changes were of such nature that they suggested definite diagnostic possibilities or pointed the way to a more definite clinical evaluation.

In conclusion, the authors emphasize the importance of the study of the sphenoidal fissures in all cases of suspected intraorbital or intracranial lesions. For the interpretation of fissure changes a sound knowledge of gross and radiographic anatomy of the orbit is essential.

WILLIS MANGES, M.D.

Management of Nonmagnetic Intraocular Foreign Bodies. Harvey E. Thorpe. Surg., Gynec. & Obst. **84:** 809–822, April 15, 1947.

An increase of from 10 to 35 per cent in the ratio of non-magnetic to magnetic intraocular foreign bodies has been noted by many ophthalmic surgeons in recent years due to the use of non-magnetic mines by the Axis powers during the war and the greater use of glass, plastics, and alloys containing non-magnetic materials in industry. Though the valuable magnet is worthless in dealing with nonmagnetic substances, the ophthalmologists are saving an increasing number of these eyes from blindness through new simplified and improved x-ray and other localization methods and improved surgical technics.

The history and a complete eye examination with all the available instrumental aids are often necessary to establish or rule out the presence of an intraocular foreign body. The following x-ray studies are advised: (*a*) a stereo postero-anterior view with the patient's chin and nose resting on the cassette; (*b*) lateral stereo of the affected eye; (*c*) soft-tissue study according to the technic of Vogt for minute fragments in the anterior segment. This last is performed "by pressing the corner edge of a dental film into the inner canthus and shooting across from the temporal side with the central x-ray beam (soft ray)."

The presence of a foreign body having been established, accurate localization is then of paramount importance. The author illustrates and describes in detail Comberg's method of x-ray localization (Arch. f. Ophth. **118:** 175–194, 1927), which has proved simple and accurate when properly applied. Briefly the procedure consists of inserting a contact lens with 4 lead markers on the limbal sclera beneath the eyelids so that the raised portion fits over the cornea and the lead markers are at, or nearly at, the 3, 6, 9, and 12 o'clock meridians. Postero-anterior and lateral views are made by a described technic. The measurements are then taken from these views, corrected by reducing them 10 per cent to allow for distortion, and plotting them on Comberg's localization chart. The author has modified the Comberg contact lens by having 3 suture holes drilled at 3, 6, and 9 o'clock near the lens' edge and anchoring it to the episclera with three silk sutures. This prevents the lens from shifting on the globe and keeps it always centered on the cornea.

The medical treatment is outlined, and operative technics are illustrated and described for the removal of non-magnetic intraocular foreign bodies from the cornea, anterior chamber, iris, lens, ciliary body, vitreous, choroid, and sclera. JOHN H. FREED, M.D.

THE CHEST

Agenesis of the Lung, with a Review of the Literature. Robert A. Burger. Am. J. Dis. Child. **73:** 481–488, April 1947.

The author describes a case of agenesis of the lung in a two-month-old Negro infant, bringing the total number of such cases reported to fifty-five. The patient was a small, poorly nourished child with a weak cry. The chest was symmetric, with dullness to percussion on the left. A film showed a dense, homogeneous opacity of the left pulmonary field with some shift of the mediastinum to the left. The intercostal spaces were wider on the right than on the left. Death occurred the day following admission.

Postmortem examination demonstrated a complete absence of the left lung, the left bronchus, pulmonary artery, and veins. The trachea descended to the left of the vertebral column and, without bifurcating, continued as the right main bronchus. Agenesis of the apical lobe and the eparterial bronchus of the right lung was also found. The right lung consisted of two lobes, the upper of which was congested, the lower atelectatic.

The classification of congenital defects of this type proposed by Schneider (in Schwalbe: Die Morphologie der Missbildungen des Menschen und der Tiere, vol. 3, pt. 2, chapter 8) has been generally accepted: (1) true agenesis with no trace of the lung, bronchus, or vascular supply; (2) small tracheal outpocketing with a rudimentary bronchus, but no pulmonary tissue present; (3) a fully formed bronchus ending in a fleshy mass of areolar tissue.

Agenesis of the lung is not incompatible with life, although associated congenital abnormalities are common. The most frequent roentgenographic diagnosis in these cases is massive atelectasis. Bronchoscopy and bronchography are valuable diagnostic aids.

M. WENDELL DIETZ, M.D.

Congenital Aplasia of the Lung. A Case Report. Wellwood M. Nesbit, Lester W. Paul, and William S. Middleton. Am. J. Roentgenol. **57:** 446–448, April 1947.

The authors report a case of aplasia of the lung of Schneider's second type (see preceding abstract), *i.e.*, with a rudimentary bronchus but no lung parenchyma.

The patient, a housewife, aged 40, complained of

afternoon fever, weakness, dyspnea, and undue fatigue on minor exertion. She stated that she had never had the reserve strength of her childhood associates and had always limited her physical activities because of dyspnea. Physical examination suggested occlusion of the left main bronchus. Bronchoscopy showed absence of the left main bronchus. Tissue removed was normal histologically.

Roentgen examination revealed a pronounced shift of mediastinal structures to the left, with herniation of the right lung across the mid-line. The anterior mediastinal space was large. The heart was displaced to the left and posteriorly. The stomach was in normal position and there was no diaphragmatic hernia. Bronchography demonstrated complete stenosis of the left main bronchus about 2.5 cm. from its origin. A partial filling of the right middle and lower lobe bronchi was obtained, showing the middle lobe to lie almost entirely in the left thorax and anterior mediastinum. The right upper lobe filled the anterior mediastinal space and the upper part of the left thorax.

H. H. WRIGHT, M.D.

Multiple Pulmonary Calcifications. Alvin C. Wyman. U. S. Nav. M. Bull. **47:** 244–248, March–April 1947.

This article reports 102 cases of multiple disseminated pulmonary calcifications discovered in a review of 110,000 photoroentgen films, an incidence of 1:1,079. The cases were of two types: uniform dissemination throughout the lungs, with an incidence of 1:5,238, and irregular dissemination throughout the lungs, 1:1,358.

The author points out the desirability of additional diagnostic procedures to determine the etiologic nature of the calcifications, more especially histoplasmin skin sensitivity tests. SYDNEY F. THOMAS, M.D.

Pulmonary Tuberculosis, Early and Differential Diagnosis. R. J. Erickson. New York State J. Med. **47:** 575–581, March 15, 1947.

The author attributes the rising incidence of new cases of tuberculosis in New York State to the increased use of x-ray examinations in civil life and by army induction boards. He stresses the value of roentgen examination for early case finding but issues a word of warning against accepting a single x-ray report as the last word and thus creating a false sense of security in the mind of the patient and the referring physician. There will always be a small group of patients with vague symptoms and negative x-ray findings in whom active disease will later develop. The value of serial films in estimating activity of a suspicious lesion is emphasized.

Sputum examinations should be combined with x-ray studies. Animal inoculations and cultures are much more reliable than concentrate smears. The author reminds us that certain cases of tuberculosis of the fibrotic type may show bacilli on culture or animal inoculation following an acute respiratory infection and thereafter give negative sputum tests.

Thorough examination of contacts, follow-up examinations for suspected early cases, and care in interpretation of skin tests are all valuable factors in the handling of the tuberculous patient. If there is any clinical suspicion of tuberculosis, the patient should be carefully followed, as it is recognized that the disease may often exhibit extensive spread in a short time.

The author stresses the value of bronchoscopy in the diagnosis of bronchial tuberculosis. Wheezing, impaired ventilation, mild atelectasis, and bleeding may be due to early bronchial tuberculosis, which is frequently diagnosed as asthma or bronchiectasis. The same symptoms may be present in primary carcinoma of the lung.

Differential diagnosis is briefly discussed, and it is pointed out that hemoptysis is more frequent in bronchiectasis than in tuberculosis. The author also emphasizes the fact that new therapeutic agents, such as streptomycin, do not obviate the necessity for the finding of early cases.

Radiologist will profit from reading this article in full because of its broad point of view in the problem of tuberculosis and its emphasis on the responsibility of the physician toward patients who are suspected of having the disease. ROBERT C. PENDERGRASS, M.D.

Coexisting Tuberculosis and Coccidioidomycosis. Harold Rifkin, Daniel J. Feldman, Lloyd E. Hawes, and Leon E. Gordon. Arch. Int. Med. **79:** 381–390, April 1947.

A case of coexisting active tuberculosis and coccidioidomycosis in a young soldier is presented.

In September 1943, while on military duty in California, the patient complained of weakness, fatigue, and pain in the left pleural area. A diagnosis of coccidioidomycosis was made by roentgen examination and the finding of double-contoured spherules of *Coccidioides immitis* in the sputum. After five months of complete bed rest, the patient returned to full military duty apparently cured. From March to August 1944 he was on active duty but complained of mild intermittent pain in the pleural area bilaterally. Repeated physical and roentgen examinations of the chest revealed no abnormalities.

In August 1945, while in the European theater of operations, the patient began to complain of sore throat and blood-streaked sputum. Weakness, pain in the right side of the chest, and malaise ensued, with a temperature range between 98.6 and 100.4° F. Roentgenography revealed pronounced collapse of the right lung, with a hydropneumothorax involving the right side. Repeated thoracenteses were performed, from 1,500 to 2,000 c.c. of fluid being removed during each procedure. No expansion of the lung was noted

In November 1945, the patient was admitted to a hospital in the United States. Roentgen studies revealed collapse of the right lung, with a large hydropneumothorax. No air was replaced after the removal of large amounts of fluid, and the lung showed no re-expansion. This, together with the physical findings, suggested the presence of a patent broncho-pleural fistula. Bronchoscopy revealed a normal tracheobronchial tree except for some shortening on the right side, which was to be expected in view of the collapsed right lung. Solution of methylene blue was instilled into all divisions of the right bronchus but could not be recovered in the pleural fluid. *Coccidioides immitis* and *Mycobacterium tuberculosis* were both isolated from the fluid. Serial roentgenologic studies revealed beginning expansion of the right lung on Dec. 29, 1945, and this has since continued progressively. It is presumed that spontaneous closure of the fistula had occurred. Conservative treatment has been continued. At the time of the report, the patient was asymptomatic, with no evidence of disseminated lesions.

Coccidioidomycosis and the Chest Roentgenogram. Dumont Clark. Rocky Mountain M. J. **44:** 203–207, March 1947.

In west Texas, parts of southern New Mexico, Arizona, and California, as many as 70 or 80 per cent of the population may give evidence of present or past infection with coccidioidomycosis; a few of these will have roentgenographically demonstrable chest lesions, which are likely to be confused with tuberculosis, sarcoid, cancer, silicosis, other fungous infections, healed abscess, or bronchiectasis.

From a roentgenographic standpoint the initial lesion in coccidioidomycosis is a pneumonia-like area of increased density in the lung of variable size and location. Shortly thereafter one or both hilar regions usually show evidence of lymph node enlargement. If the disease does not disseminate, the pneumonia-like areas will regress in a period of weeks or months. Frequently the initial lesion is confused with so-called virus or atypical pneumonia. As healing takes place, the lesion may disappear or remain unchanged. If not, a rounded nodular or strand-like area of density which often extends into the hilum is left. Occasionally a central area of lesser density develops in the nodules, giving the appearance of a cavity.

Clinically as well as pathologically coccidioidomycosis mimics tuberculosis very closely, an important difference being that in adult reinfection tuberculosis mediastinal adenopathy is absent. A skin test is similar in mechanism to that for tuberculosis, and, like it, is based on a sensitivity reaction. It has much the same value as a tuberculin test. A negative test rules out the disease in most instances, but a positive test does not necessarily mean that the lesion is one of coccidioidomycosis. A diagnosis can be made with certainty only when *Coccidioides immitis* is found in the sputum or in a lesion. Unfortunately demonstration of the organism is difficult except early in the disease and in those rare cases in which a chronic cavity is discharging into a bronchus.

This article is clear, comprehensive, and complete; it is recommended to anyone wishing concise and accurate information on coccidioidomycosis.

PERCY J. DELANO, M.D.

Bronchopulmonary Actinomycosis. Earle B. Kay. Ann. Int. Med. **26:** 581–593, April 1947.

Actinomyces israeli is commonly found in chronic bronchopulmonary infections. Of 240 patients treated over a six-month period for such infections, 109 showed this organism in sputum specimens, and in 65 it was isolated from bronchial exudates obtained bronchoscopically. It is felt that the presence of the fungus is less of a factor in influencing the clinical course, response to treatment, and prognosis of chronic bronchopulmonary infections than the mechanical factors of bronchial occlusion, tissue destruction, avascularity, and fibrosis. Operations were performed when indicated and in no patient was actinomyces responsible for any postoperative complication. Apparent cures have now resulted following pneumonectomy in two patients and lobectomy in four patients. Three other patients having abscesses were cured by surgical drainage alone.

The author takes as the basis of his discussion 20 patients (apart from those having bronchiectasis, chronic bronchitis, and suppuration distal to an obstructing carcinoma) from whom actinomyces were obtained bronchoscopically from bronchial exudates or from chest wall sinuses. Actinomyces in addition to other organisms was isolated in approximately 50 per cent of all patients having chronic lung abscesses and pulmonary suppuration.

The onset of pulmonary infection was frequently insidious and characterized by a low-grade fever that later became septic, a productive cough, pain in the chest, and increasing debility. Bloody sputum was present in all patients at one time or another. The clinical course was featured by remissions and exacerbations. The onset usually followed episodes of exposure, fatigue, and weight loss incident to military life.

The response to treatment of patients with chronic pneumonitis, lung abscesses and pulmonary suppuration appeared to depend largely on the chronicity and severity of the infection. It is essential in such cases that penicillin and sulfadiazine be given in large doses and continued for a long time in spite of roentgen clearing and clinical improvement; otherwise recurrence will take place. The dosage of penicillin employed consisted of 50,000 units intramuscularly every three hours for eight to twelve weeks, or even longer. A blood level of 10 mg. per cent of sulfadiazine was maintained.

Five patients with roentgen evidence of pneumonitis and without evidence of cavitation responded excellently to penicillin and sulfadiazine therapy. All of these patients had had their disease from three to five months. In one of them a recurrence proved resistant to further chemotherapy.

If cavitation were present, less benefit from chemotherapy and antibiotic therapy resulted, though the general symptoms of toxicity were allayed and symptomatic improvement was observed, frequently associated with roentgen clearing of the pneumonitis surrounding the cavitation. In only one patient did the abscess heal following conservative measures alone.

Four of the six patients having pulmonary resections were treated postoperatively with sulfadiazine in combination with penicillin and the other two with penicillin alone. In one instance a draining chest wall sinus secondary to pulmonary and pleural involvement healed after a four-week course of sulfadiazine.

STEPHEN N. TAGER, M.D.

Q Fever in the United States. II. Clinical Data on an Outbreak Among Stock Handlers and Slaughterhouse Workers. J. V. Irons and John M. Hooper. J. A. M. A. **133:** 815–818, March 22, 1947.

This is one of a group of four consecutive papers covering various aspects of an outbreak of Q fever which occurred among stock handlers and slaughterhouse workers at Amarillo, Texas. It deals with the clinical and roentgen features.

There was wide variation in the severity of the condition, which ranged from mild influenza-like attacks to grave illnesses with two deaths among the 55 persons affected. The most outstanding observations were the rather abrupt onset associated with frontal headache, chilly sensations, and general malaise, high fever of five to fifteen days' duration, essentially normal white blood count, roentgenologic evidence of pulmonary lesions with minimal symptoms referable to the respiratory tract, and comparatively rapid convalescence. Sulfonamide and penicillin therapy were ineffective. Cutaneous lesions present in other rickettsial diseases were not observed.

Recognition of pulmonary or pleural abnormality in roentgenograms aids in differentiating this condition from typhoid, typhus, and brucellosis. Acute onset, lack of upper respiratory symptoms, rapid convalescence and lack of cold agglutinins in convalescent serum allow differentiation from primary atypical pneumonia. Lack of contact with birds rules out psittacosis. The diagnosis must be established primarily on the basis of laboratory procedures, with particular reference to increasing complement-fixation titer during convalescence and after recovery.

Roentgenograms showed a patchy type of increased density, soft and diffuse in character, and usually lacking the uniform density seen in lobar pneumonia. The areas of involvement were single or multiple, but seldom was more than one lobe involved. The left lower lobe was most often affected.

Q fever requires consideration in the differentiation of atypical and non-bacterial pneumonias and undiagnosed acute febrile illnesses.

E. M. WRIGHT, M.D.
(University of Michigan)

Rheumatic Pneumonia. Donald W. Seldin, Henry S. Kaplan, and Henry Bunting. Ann. Int. Med. **26:** 496–520, April 1947.

The object of the present study was to establish criteria by means of which a clinical and roentgen diagnosis of rheumatic pneumonia might be ventured. With this in mind an analysis was made of 6 cases which at autopsy manifested the characteristic anatomical features of rheumatic pneumonia. All cases exhibited clinical, laboratory, and anatomical evidence of active rheumatic carditis.

In an attempt to evaluate the incidence of rheumatic pneumonia as well as other pleuropulmonary complications in chest roentgenograms, a series of 100 episodes of acute rheumatic fever in 91 patients admitted to the New Haven Hospital from 1937 through 1945 were studied. Three of the 6 cases verified at autopsy were from this group.

The roentgen appearance of rheumatic pneumonia is indistinguishable from that usually associated with cardiac failure. The significance of the pulmonary roentgen findings in rheumatic heart disease with and without decompensation has yet to be elucidated. For convenience, the pulmonary roentgen changes associated with rheumatic heart disease are grouped under three categories: (1) *vascular engorgement*, with an increased prominence of the pulmonary arterial shadows throughout both lung fields; (2) *pulmonary congestion*, characterized by the presence of coarse, fuzzy, arborizing linear shadows, radiating out from the hilar regions and presumably vascular, whose irregular margins merge gradually with the adjacent aerated lung parenchyma; (3) *pulmonary edema*, characterized by a diffuse, moderately dense, fluffy or hazy parenchymal infiltration which is usually bilateral, multilobar, and often assumes a "butterfly" distribution, with a peripheral clear zone of emphysema, and with varying degrees of obliteration of individual vascular shadows. The cases studied exhibited each of these three appearances, though pulmonary edema was the most common.

In the presence of suitable clinical data, a roentgen appearance characterized by widespread, bilateral, multilobar, non-segmental infiltration should suggest the diagnosis of rheumatic pneumonia and aid in its differentiation from bacterial and primary atypical pneumonic consolidations.

In their larger study of pleuropulmonary complications of rheumatic fever, the most common pulmonary lesions noted, occurring in 27 per cent of the attacks, were vascular engorgement and pulmonary congestion, usually associated with cardiac failure.

In contrast to the lungs of acute pulmonary edema, the sectional pulmonary surfaces in rheumatic pneumonia, though appearing moist, fail to exude frothy, serosanguineous fluid. This absence of a thin, liquid exudate may explain the striking absence of râles in the latter condition, while the peripheral zone of emphysema so clearly brought out by roentgen examination may be related to the absence of dullness to percussion or changes in tactile fremitus.

Despite their distinctly different pathologic character, pulmonary edema and rheumatic pneumonia share a common, or at least closely similar, roentgen appearance. This fact, together with the non-segmental, multilobar distribution, suggests that the pathogenesis of rheumatic pneumonia is based upon a diffuse pulmonary vascular lesion, to which the exudate, pseudomembranes, and cellular infiltration are secondary.

A uniform clinical picture was encountered, characterized by an abrupt onset of profound respiratory distress in the absence of commensurate physical signs in the chest. Hacking cough with scanty, blood-streaked sputum, moderate to high fever, and leukocytosis were also present. No instance of lobar or primary atypical pneumonia was encountered in this series, and pneumonitis secondary to bronchiectasis was found only twice.

All cases of rheumatic pneumonia observed in this study terminated fatally. Therefore, this manifestation of rheumatic fever would appear to carry a grave prognostic significance. STEPHEN N. TAGER, M.D.

On the Incipient Stages of Porcelain Silicosis. Preben Eskildsen and P. Flemming Møller. Acta radiol. **27:** 601–606, Dec. 20, 1946.

A follow-up study on porcelain workers investigated in 1933 and 1934 by Gudjonsson and Flemming Møller (see Acta radiol. **15:** 587, 1934) is presented, and the difficulty in the roentgen diagnosis of early changes is emphasized. Since porcelain silicosis is manifested primarily by peribronchial and perivascular fibrosis and is seldom associated with nodular lesions, the elements of normal variation in chest roentgenograms as well as technical variation in quality must be considered carefully. The present study was based on interpretation of films only. In 17 of the 39 cases reviewed, the changes were considered to be less marked on the second examination; in 13 there was no change, and in only 9 were the lesions regarded as more severe. It is concluded that only after porcelain silicosis has reached the second stage roentgenographically, can the diagnosis be made with any certainty.

ELIZABETH A. CLARK, M.D.

Cadmium Poisoning by Inhalation. Report of a Case. Frank F. Huck. Occup. Med. **3:** 411–414, April 1947.

Cadmium is capable of acting as a poison both by inhalation of the fumes of the metal and by ingestion. Poisoning by way of the respiratory route produces few immediate symptoms and the worker has no warning of

danger and may continue to work in the fumes for several hours. Within four to eight hours, irritation of the throat, headache, cough, and chills or alternate feelings of heat and cold develop. Within twenty to thirty-six hours after exposure, symptoms of pulmonary edema appear, with shortness of breath, pain in the chest, persistent cough, and weakness. Roentgenograms at this time may show widespread patchy bronchopneumonia or areas of pneumonitis. The pulmonary edema either progresses to termination by anoxemia due to collapse of the pulmonary tissue, hemorrhage, etc., or to recovery within one to two weeks. A case of cadmium poisoning in an arc welder with recovery in about two weeks and with no sequelae is presented.

Primary Bronchogenic Cancer Mistakenly Diagnosed as Pulmonary Tuberculosis. Case Reports with Body Section Roentgenography. Waldo R. Oechsli and Kenneth B. Olson. Am. J. Roentgenol. **57:** 429–434, April 1947.

Among 11,752 patients admitted to a sanatorium for tuberculosis during a nineteen-year period, 16 cases of proved primary bronchogenic carcinoma were diagnosed. The symptomatology and physical signs were similar enough to those of tuberculosis to be misleading, indicating the necessity for other diagnostic tests. Two-thirds of the patients tested with tuberculin were negative. The sputum was negative for tubercle bacilli in all 16 cases. Pleural effusion was present in 6 cases the fluid being negative for tubercle bacilli. Tumor cells were found in the fluid in one case.

Direct visualization of the bronchial tree by bronchoscopy is the most reliable means of diagnosis of bronchogenic carcinoma. Positive diagnosis was obtained in 5 of 8 cases in this series in which bronchoscopy was done. Pulmonary wheeze should suggest the possibility of a bronchial tumor and lead to bronchoscopic study.

The most common roentgenographic appearances of bronchogenic carcinoma are a dense nodule or mass in the parahilar region and the presence of atelectasis. These findings are not the usual ones in tuberculosis. Body-section roentgenography has been found particularly useful in demonstrating defects in or occlusion of bronchi, which permits a presumptive diagnosis of bronchogenic carcinoma.

Two cases are presented. Both patients were admitted with a diagnosis of pulmonary tuberculosis, and both showed an abnormal density in the upper left lung. Planigrams in both cases revealed abnormality of the left upper lobe bronchus considered to be due to bronchogenic carcinoma. In one case bronchoscopic visualization was possible and a biopsy specimen was obtained, confirming the diagnosis. In the other case two bronchoscopic examinations were made, but no tumor was demonstrable. Autopsy in both cases confirmed the presence of bronchogenic carcinoma in the location and of the extent indicated by the planigrams.

H. H. WRIGHT, M.D.

Report on Four Cases of Pulmonary Carcinomatosis Simulating Pulmonary Tuberculosis. G. T. O'Brien. Irish J. M. Sc., April 1947, pp. 175–178.

Four cases of lymphangitic carcinomatosis of the lung are presented which were originally diagnosed as pulmonary tuberculosis. Three of the cases subsequently revealed primary involvement of the stomach, and the fourth a small bronchogenic carcinoma.

The author stresses the pitfalls which may arise from a single radiographic examination of the chest or from too close concentration upon symptoms from one system without due regard to the patient's general condition.

LOUIS BERNSTEIN, M.D.

Pulmonary Cysts. Herman J. Moersch and O. Theron Clagett. J. Thoracic Surg. **16:** 179–194, April 1947.

The authors review 44 proved cases of pulmonary cyst seen in the Mayo Clinic over a ten-year period. They divide all pulmonary cysts into two groups, those of bronchial and those of alveolar origin. The question as to whether cysts are acquired or congenital they do not regard as satisfactorily established, but they believe that there are certain acquired elements which may be of importance in the development of some cysts.

All of the 44 cases reported fall in the group of bronchial cysts. They are further subdivided into three types. In the *first*, elements of the bronchial wall and epithelial lining could be found microscopically (27 cases). In the *second*, the cysts grossly resembled those of the first type, but microscopic study showed the walls to be largely fibrous tissue and there was no epithelial lining (9 cases). The *third* type was a cystic dilatation of the bronchi of a greater diameter than 3 cm. (8 cases). This last type is in reality a cystic bronchiectasis but is included as it sheds some light on the development of true pulmonary cysts.

The cysts were found in all parts of the lung, but more commonly in the right lower lobe. In 2 cases carcinoma developed in the wall of the cyst, which the authors feel is one reason for removing even asymptomatic cysts. Cough, expectoration, hemoptysis, dyspnea, and pain were the most common symptoms. Only seven patients had no symptoms. Pulmonary cysts with bronchial communication are more likely to give rise to clinical manifestations than the non-communicating cysts, although the latter cause symptoms by pressure on neighboring bronchi and subsequent bronchial infection.

Roentgenograms of the chest were of greatest value in differential diagnosis, and several examples are reproduced. Bronchograms and bronchoscopy were of little help.

HAROLD O. PETERSON, M.D.

Hydatid Cyst of the Lung of Unusual Size. Report of a Fatal Case. I. A. M. Prior. New Zealand M. J. **46:** 109–113, April 1947.

A case of single pulmonary hydatid cyst which produced death by its mechanical effect is presented. This report is chiefly of value for the information which it adds on the rate of growth of these cysts. A cyst 5 inches in diameter in the base of the left lung was revealed by a chest roentgenogram when the patient was examined for military service at the age of twenty-seven. Medical care was refused at that time. When the patient died, six years later, the cyst occupied two-thirds of the thorax. Attacks of pleuritic pain and cough, lasting four to ten days, had occurred once to three times a year since early childhood, due probably to irritation of the pleura by the then small hydatid cyst.

Hemothorax and Empyema in a Thoracic Center. George N. J. Sommer, Jr., and Waldo O. Mills. J. Thoracic Surg. **16:** 154–178, April 1947.

There were admitted to a thoracic center in England

229 patients with intrapleural fluid or drained empyemas. The cases were classified as simple hemothorax, clotted hemothorax, infected hemothorax, and empyema. The presence of intrapleural foreign bodies and the severity of the initial wound, especially abdominothoracic wounds with gastro-intestinal and hepatic injury, are the two most important factors in the production of post-traumatic pleural infection.

Simple hemothorax is treated by repeated aspiration to dryness without air replacement. If clotted hemothorax does not respond to aspiration and breathing exercises, thoracotomy and decortication are the proper treatment. Adequate dependent open drainage remains the most important method of treatment for infected hemothorax and empyema. Decortication is an operation of great value, however, in the treatment of these conditions under proper indications and with suitable surgical personnel.

Voluntary respiratory exercises, which are combined with early ambulation and proper general care, are an essential part of the rehabilitation of thoracic casualties. The thoracic patient should leave the hospital embued with the feeling of complete physical recovery.

The bacteriologic findings in the pleural infections were extremely varied. Different combinations of twenty organisms were present in the cases studied. Many of the organisms isolated were not sensitive to penicillin.

This is a long paper with many case reports, plus the corresponding roentgenograms. No unusual roentgen findings are brought out. The authors felt that the use of the Lysholm grid was essential for the lateral views.

HAROLD O. PETERSON, M.D.

Roentgen Diagnosis of Arterio-Venous Aneurysm of the Lung. E. Lindgren. Acta radiol. **27:** 585–600, Dec. 20, 1946.

Arteriovenous aneurysms in the lungs produce the characteristic roentgen findings of a tumor from which broad vessel shadows lead to the hila. These vessels may be tortuous, and pulsation may or may not be present. Size diminishes during the Valsalva test and increases during the Müller procedure. When diagnosis is not possible from plain film studies alone, planigraphy and angiography are helpful. Difficulties in diagnosis may be encountered if there has been interstitial hemorrhage from the aneurysm into the adjacent lung, in the unusual aneurysm of branches of the pulmonary artery, when multiple small peripheral arteriovenous aneurysms exist, or, conceivably, if small round inflammatory lesions occur adjacent to vascular shadows. The importance of recognizing the roentgen evidence of pulmonary arteriovenous aneurysm has become increasingly important as it has been found possible to help these patients by operative treatment.

In the 3 cases reported here and 2 cited from the literature, the roentgen findings were diagnostic. Clinically, all the cases exhibited cyanosis, clubbing of the fingers, dyspnea, and indications of severe circulatory impairment. In only one of the author's cases was there cardiac enlargement, and this was believed to be due to rheumatic heart disease. In two cases, recurrent hemoptysis was a prominent feature, and one of these had associated attacks which the neurological consultant attributed to air emboli to the brain. The surgical procedure and operative findings are presented for 2 of the author's 3 cases.

ELIZABETH A. CLARK, M.D.

Heart Catheterization in the Investigation of Congenital Heart Disease. Arnold L. Johnson, Delbert G. Wollin, and Janice B. Ross. Canad. M. A. J. **56:** 249–255, March 1947.

Following a brief review of the newest methods of diagnosis of congenital heart disease, the authors present their technic of cardiac catheterization, utilizing an F-8 or F-9 catheter, which is preferably introduced in the median cubital vein and passed, under fluoroscopic guidance, into the heart chamber. Saline drip is continued during the passage of the catheter to maintain patency, and the patient is previously heparinized, to minimize clotting tendency. Following the passage of the catheter to the proper anatomical site, blood samples are taken and roentgenograms are made at the site of blood withdrawal. Preoperative sedation consists of various quantities of morphine, scopolamine and nembutal according to the patient's age, and the use of intravenous morphine and avertin during the diagnostic procedure.

Adverse effects of this type of catheterization were few, apart from extrasystoles, one case of tachycardia, and some slight thrombophlebitis. One infant died one month after catheterization of the right saphenous vein and a clinically unsuspected thrombus was found occluding the inferior vena cava.

Of 17 patients studied, 9 were considered to have interventricular septal defects by reason of arterialized blood in the right side of the heart when oxygen determination of blood in the right ventricle was compared with that of the superior vena cava. Detailed analysis of this form of interpretation is presented with each case reviewed. In a similar manner auricular septal defects were demonstrated and interpreted. In these cases arterialized blood was found in the right auricle when blood oxygen determination was compared to the blood in the superior and inferior venae cavae.

Following catheterization the patient is given penicillin intramuscularly, 5,000 to 10,000 units every three hours for a period of forty-eight hours.

ALFRED H. DOBRAK, M.D.

A Characteristic Kymographic Aspect of Mitral Stenosis. Franco Hueber. Radiol. med. (Milan). **33:** 115–118, March 1947.

Several Italian observers, as Perona, Cignolini, and Hueber have made valuable contributions to the study of roentgenkymography. Hueber adds to his previous work the observation that, due to the lengthened emptying time of the left auricle in mitral stenosis, the four serrations of the auricular contraction are flattened instead of being sharply outlined.

CESARE GIANTURCO, M.D.

THE DIGESTIVE SYSTEM

Congenital Atresia of the Esophagus with Tracheo-Esophageal Fistula. Report of Additional Cases. William H. Bradford. Texas State J. Med. **42:** 634–637, March 1947.

The diagnosis of esophageal atresia should be suspected whenever vomiting, coughing, strangling, or respiratory difficulty occurs within the first few hours of life. Externally, the appearance of the infant is not unusual except for drooling. Periods of choking and cyanosis occur between feedings. Feedings and water are taken avidly, but after a few swallows, the symp-

toms are repeated. If a gavage tube meets an obstruction, further investigation is indicated.

A preliminary scout film of the chest and abdomen is often helpful. If there is air in the stomach and intestine, a tracheo-esophageal fistula may be assumed, providing the obstruction to the gavage tube is confirmed by iodized oil injection showing the upper esophageal segment terminating blindly. If there is no air in the stomach or intestine, there may be complete atresia or agenesis of the lower segment. Esophagoscopy and bronchoscopy may be of aid in localizing the fistulous opening and determining the length of the space between the two segments of the esophagus.

Recent surgical progress has indicated the feasibility of attempting primary anastomosis of the esophagus and the futility of gastrostomy as a curative measure. The author reports 2 cases, supplementing 3 earlier ones (Dallas M. J. **25:** 91, 1939). In both, the upper segment of the esophagus ended in a blind pouch at the level of the second thoracic vertebra and the lower segment opened into the trachea at the carina. In both cases, primary anastomosis of the two segments was attempted. One child died one-half hour postoperatively. The other survived over one year, but had recurrent pulmonary infection, which eventually proved fatal.

BERNARD S. KALAYJIAN, M.D.

Polypoid Tumors of the Esophagus: Clinical, Anatomic, Radiologic, and Therapeutic Considerations. Enrico Bozzi and Pier Luigi Cova. Radiol. med. (Milan) **33:** 161–208, April 1947.

The authors report on 7 cases of polypoid esophageal tumors observed in a period of two years at the University of Milan. All patients were studied radiologically and by esophagoscopy. Biopsies were taken from all. The roentgenologic description is accompanied by good films and schematic drawings and illustrates very well the appearance of these tumors. Histologically, the tumors were classified as follows: one polymorph sarcoma, one undifferentiated carcinoma, one adenocarcinoma, one Malpighian papillary fibroepithelioma. Three tumors could not be definitely diagnosed histologically either because of an insufficient specimen or because of their confusing histologic nature. While these cases were very well studied, one is left a little undecided by pathological diagnoses such as "papillary Malpighian fibroepithelioma" and "polymorph sarcoma." It is certainly to be hoped that the new scientific contacts will stimulate the use of commonly accepted histological terms.

CESARE GIANTURCO, M.D.

Esophageal Leiomyoma. Report of a Successful Resection. Paul W. Schafer and C. Frederick Kittle. J. A. M. A. **133:** 1202–1205, April 19, 1947.

Reports of approximately 200 benign esophageal tumors are reviewed, including adenoma, papilloma, polyp, fibroma, myxofibroma, neurofibroma, hemangioma, lipoma, osteochondroma, and myoma. Benign tumors of the esophagus can be divided into two general types, depending on whether they originate from the mucosa and submucosa or from the muscularis. The most commonly observed type, the myoma, originates from the muscular coats. Myomas and other intramural tumors produce symptoms by their expansile growth into adjacent structures and seldom cause dysphagia. The presence of a myoma should be suspected when indefinite esophageal or intrathoracic complaints are coupled with a posterior mediastinal mass. However, the difficulties of exact diagnosis are shown by the citation of only one correct preoperative diagnosis from the case reports reviewed.

In 6,001 postmortem examinations at the University of Chicago, 11 benign esophageal tumors were found. The first successful resection of a large intramural leiomyoma of the esophagus is reported in detail. An associated diaphragmatic hernia was thought to be secondary to traction exerted by the expanding tumor.

E. M. WRIGHT, M.D.
(University of Michigan)

Roentgen Differentiation of Benign and Malignant Ulcers. Marcy L. Sussman and Joan J. Lipsay. Surg. Clin. North America **27:** 273–287, April 1947.

This article serves to emphasize a truism that "unequivocal differentiation of benign and malignant ulcer of the stomach cannot be made roentgenologically." This must be achieved histologically. However, it is carefully brought out that the roentgen examination is the least distressing to the patient, and, in general, most informative and therefore should be the initial test and should be universally applied.

The typical benign non-calloused ulcer appears as a smooth rounded projection on the gastric contour when the patient is turned so as to bring it into profile. The adjacent gastric wall is not indurated, so that roentgenologically there is no rigidity or loss of flexibility. The entire niche is outside the gastric lumen and the wall adjacent to the niche usually is at the same level as the rest of the gastric outline. The surrounding mucosal folds are not significantly altered in width and may radiate toward the niche. Malignant lesions can be classified as follows: (1) a polypoid tumor with an overhanging edge and a nodular surface, barely ulcerated; (2) an ulcer surrounded by an elevated wall which is sharply demarcated from the surrounding mucosa; (3) an ulcer with a wall which is likely to be present only on one side and diffuse progressive infiltration into the neighboring mucosa, the folds appearing stiff, broad, and prominent; (4) diffuse infiltration, in which case, if an ulcer is present, there is no wall. The malignant ulcer represents in most cases an eroded neoplasm and the niche usually is only a part of the neoplastic process, lying within the normal contours of the stomach. The complicated benign ulcer may well give one or two signs of the malignant ulcer, and, therefore, lead to some confusion.

Under the heading "Indirect Signs," the authors discuss the location of the niche. If the niche appears above the incisura angularis on the straight or vertical portion of the stomach, it is "almost always benign." By contrast, however, a niche on the horizontal portion of the lesser curvature should be regarded as suspicious of neoplasm, although its appearance may be otherwise benign. Ulcers about the cardia and subcardiac area as well as those on the anterior and posterior walls, are more often malignant than benign, but the differential is not great enough to be of sufficient value in considering the individual case. An ulcer on the greater curvature, of course, is almost invariably malignant, while a true pyloric ulcer is always thought to be benign.

The size of the crater is of no value in the differential diagnosis, and its depth is important only when it projects outside of the wall of the stomach (benign) or lies within the gastric contour (malignant).

Associated lesions, such as duodenal ulcer, are usually suggestive of benign ulceration, but the possibility of a benign duodenal ulcer with a malignant lesion of the stomach exists. [Multiple ulcers of the stomach also suggest benignity.]

A diminution in the size of the niche and its eventual disappearance, are, of course, considered a reliable sign of a benign ulcer. An ulcer which shows no regression on active therapy, while it may be benign and calloused, must be regarded as suggestive of neoplasm.

SYDNEY F. THOMAS, M.D.

Coexisting Ulcer and Cancer of the Stomach. Harry Yarnis. Surg. Clin. North America **27:** 299–307, April 1947.

The presence of benign ulcer and an independent carcinoma in the same stomach is an unusual occurrence. Three cases are reported in detail, with illustrations.

The author points out that antral spasm secondary to ulceration above the incisura angularis may cause mild degrees of gastric retention. However, high-grade pyloric obstruction causing six-hour residues exceeding 50 per cent of the ingested barium meal must be due to pyloric or juxtapyloric obstruction. It is well to remember that about 8 per cent of gastric ulcers are associated with duodenal ulcers.

When the clinical picture is atypical, the presence of benign gastric ulcer should not preclude a search for an independent carcinoma, which need not originate in the ulcer.

SYDNEY F. THOMAS, M.D.

Problems in the X-ray Diagnosis of Early Cancer. Kenneth S. Davis. California Med. **66:** 117, March 1947.

The roentgen findings in gastric carcinoma are a filling defect, palpable mass, absence of peristalsis in the involved area, lack of flexibility of the stomach wall, alteration of the mucosal markings and disturbance in the passage of barium through the stomach. The roentgen diagnosis of operability is determined by the extent of the growth, its location and fixation. The latter generally indicates extension beyond the stomach wall. In all cases in which the roentgenologist questions the diagnosis, gastroscopy should be done.

Carcinoma may develop on the basis of a gastritis, polyps, or gastric ulcer. In the diagnosis of gastritis, the roentgenologist is of very little help unless the disease is far advanced. Roentgen findings include thickening of the gastric mucosa, some stiffness of the wall, as well as absence of peristalsis. Polyps may be either congenital or acquired, and are conclusively diagnosed by gastroscopy and biopsy. When an ulcer is large, peristalsis is absent, and the rugae are obliterated, carcinoma should be considered.

MAURICE D. SACHS, M.D.

Giant Hypertrophic Gastritis. Samuel N. Maimon, Jay P. Bartlett, Eleanor M. Humphreys, and Walter Lincoln Palmer. Gastroenterology **8:** 397–428, April 1947.

Giant hypertrophic gastritis is a rather rare condition. It assumes clinical importance only because it may simulate a malignant lesion and in some cases is thought to represent a possible premalignant proliferation of the gastric mucosa. The authors describe 6 surgically verified cases and present good illustrations.

Among nearly 6,000 gastroscopic examinations, the incidence of giant hypertrophic gastritis as proved surgically and by x-ray and gastroscopic observations was approximately 0.17 per cent. The cause is unknown. The clinical picture does not fit any specific syndrome or conform to any typical pattern. The most usual pattern is that found with benign ulceration of the stomach or duodenum.

The chief roentgen manifestation is the extremely prominent mucosal folds, especially in the mid portion of the greater curvature. These are greatly thickened and indurated, tending to produce an exaggerated saw-tooth appearance, often with broad, deep, sharp notches. In all but one of the authors' cases, the enlarged rugae were extremely soft, yielding to pressure, the gastric walls were pliable, and there was little impairment of peristalsis. Mucosal edema, due to inflammation, hyperproteinemia, and perhaps trauma, may increase the size and consistency of the folds, as in 2 of the cases in this series.

The gastroscopic appearances were similar in all 6 cases, but so far as differentiation from malignant growth is concerned, gastroscopy proved to be of little more value than radiographic methods.

The pathological aspects of this disease are discussed, with excellent photographs of the specimens as well as low-power photomicrographs of rather large sections of the gastric mucosa clearly demonstrating the "mammillated" changes in the glandular epithelium. These changes are shown going on to adenomatous polyp-like lesions, with cyst formation in the epithelium.

It is of interest to note that in 3 of the 6 cases, a diagnosis of "tumoral gastritis" was made. In another, this entity was considered strongly, but no outright statement was made.

The striking thing, histologically, is the redundancy of the mucosa and the marked hypertrophy of the glandular structures with cyst formation and metaplasia of the epithelium to the intestinal type. It is noted that the pepsinogen- and acid-forming cells were replaced by a more primitive type. "Fibroplasia" with increase in connective tissue and edema were prominent features.

SYDNEY F. THOMAS, M.D.

Duodenal Diverticulum. Arthur N. Collins. Minnesota Med. **30:** 268–271, March 1947.

The author's evaluation of his own results in the removal of duodenal diverticula seems to represent a *post hoc ergo propter hoc* sort of reasoning: the first case report is quite unconvincing, and the review of cases gleaned from hospital records leaves the burden of proof about as heavy as ever. Two operative cases are cited from such records, with the comment that x-ray showed a "favorable result," meaning presumably that after the diverticulum was removed, its absence was demonstrable.

This article is cited only to be condemned: it might be very misleading to beginners in medicine, who frequently fail to scan published statements with the skepticism necessary to their own and their patients' well-being.

There are at least two pertinent things to be said of duodenal diverticula, but the author does not say them. The first is that the diverticulum may contain remnants of pancreatic tissue; this is usually not of clinical importance, but has come in for consideration when dealing with a patient who presents evidence of a pancreatic tumor causing hypoglycemia. The second thing con-

cerns these diverticula when they arise in such proximity to the ampulla of Vater that they may, when filled (a narrow neck preventing emptying), make sufficient traction to occlude the ampulla and thus produce obstructive jaundice.

With these two exceptions, one may well adopt the point of view expressed by Kirklin that duodenal diverticula are mentioned in the roentgenologist's report only for the sake of thoroughness, and not because clinical significance is to be attached to them.

PERCY J. DELANO, M.D.

Enterogenous Cysts of the Duodenum. Case Report and Review of Literature. Thomas A. Shallow, Frederick B. Wagner, Jr., and W. Bosley Manges. Surgery **21:** 532–541, April 1947.

The fourteenth case of enterogenous cyst of the duodenum is added to the literature. These cysts are intimately adherent to some portion of the duodenum, they contain fluid, and their walls are composed of all layers of the intestine. They are generally believed to be the result of a developmental defect. Several possible mechanisms are discussed whereby they may arise.

Symptoms are those of partial occlusion of the duodenal lumen, including abdominal pain, vomiting, and melena. All the reported cases have been in children, the average age being three years.

The case reported is that of a 12-year-old boy who had suffered recurring attacks of partial high intestinal obstruction since the age of one year; he passed tarry stools just prior to admission. Abdominal examination was negative. Roentgen-ray study revealed an obstructive lesion in the duodenum. At operation an enterogenous cyst was successfully removed, with complete recovery. Frequently removal is not possible due to a more integral attachment in the duodenal wall. In such cases internal drainage or gastrojejunostomy is indicated.

J. E. WHITELEATHER, M.D.

Duodenal Ulcer and Hookworm Infestation: Diagnostic and Military Medico-Legal Problem. Henry A. Monat and Irving S. Cooper. U. S. Nav. M. Bull. **47:** 338-342, March–April 1947.

Hookworm infestation "in a majority of cases" shows roentgenologic changes in the duodenum. Local circumscribed hemorrhage in the intestinal wall, especially the submucosa, causes a thickening of the folds demonstrable roentgenographically. Thus, while duodenal ulcer may accompany hookworm infestation, the latter may of itself produce a defect simulating ulcer, with clinical and laboratory findings suggestive of that diagnosis.

Since it takes time for the reversal of the duodenal deformity of hookworm disease—four to six weeks after administration of the vermifuge in the authors' experience—repeated roentgen studies are important to show the return to normal and thus rule out a concomitant ulcer. This is of special significance in the armed forces, since disability due to ulcer is considered pensionable.

Three cases are reported in some detail—one of uncomplicated hookworm infestation and two with an associated duodenal ulcer, as evidenced by a persistent defect.

The bibliography is worth noting; though not extensive, it is reasonably complete.

SYDNEY F. THOMAS, M.D.

Intestinal Ascaris Diagnosed Roentgenographically in Minnesota. R. S. Leighton and R. J. Weisberg. Minnesota Med. **30:** 410–411, April 1947.

A case of intestinal ascariasis in a 31-year-old veteran, diagnosed by barium enema studies, is reported. The worm could not be made out when the barium was given by mouth. Stool examinations were negative for ova and parasites. Following administration of magnesium sulfate and hexylresorcinol, an 8-inch male *Ascaris lumbricoides* was expelled, and the patient was completely relieved of diarrhea and abdominal cramps.

Diagnosis of Ascaris Infestation by Serial Roentgen Examination of the Small Intestine. J. E. Lofstrom and D. A. Koch. Am. J. Roentgenol. **57:** 449–452, April 1947.

The authors report six instances of *Ascaris lumbricoides* infestation diagnosed roentgenologically in 100 small intestinal series done in an army hospital in Italy and France. None of these patients was referred with a previous clinical diagnosis of ascariasis. The parasites were recovered from the stool in all instances.

The diagnosis was made on demonstration of a sharply outlined linear defect in the barium filling of the small intestine. The worms varied from 2 to 15 cm. in length and were found from the upper jejunum to the lower ileum. None was detected by roentgenoscopy. Twenty-four-hour check roentgenograms failed to reveal any barium residue in the intestinal tract of the parasite. No effect on intestinal motility was noted, and there was no noticeable change in the lumen or texture of the mucosal pattern of the intestine.

H. H. WRIGHT, M.D.

Early Postoperative Motor Response of the Small Intestine to Jejunal Feedings. Stephan Rosenak and Franklin Hollander. Surg. Clin. North America **27:** 345–354, April 1947.

In order to determine whether the impairment of gastro-intestinal activity following jejunostomy is sufficient to invalidate the use of intrajejunal feeding postoperatively, a study was made of five patients. The immediate objective was to discover whether the massive introduction into the jejunum of 100 c.c. of a predigested aliment (with barium added) distends the bowel unduly, or whether the material is transported aborally at a rate sufficient to permit its routine administration. Roentgen studies were made on the second day after operation at various intervals following feeding and control films were obtained on the same patients three weeks later. The findings are well illustrated in two charts, which record the progress of the barium through the gastro-intestinal tract.

It is concluded that jejunal feeding with predigested aliment may be instituted as early as twenty-four hours following operation provided certain precautions are observed, as injection of small amounts every five minutes rather than large amounts in single feedings, and supportive treatment with parenteral fluids. Since there is apparently little or no retrograde movement of the material, it seems unlikely that such feeding jeopardizes the "weak spot of gastric surgery, the duodenal stump."

SYDNEY F. THOMAS, M.D.

The Unstable Colon: Its Role as a Precursor to Diverticulosis. E. A. Schexnayder. New Orleans M. & S. J. **99:** 496–499, April 1947.

The author feels that the colonic neuroses are a pre-

cursor to diverticulosis of the large bowel. He reviews the classification of these neuroses as established by Bockus and Willard and enters into a discussion of the motor neuroses with specific emphasis on the unstable colon.

The unstable colon is considered to be a constitutional condition frequently characterized by manifestations of a labile autonomic nervous system with specific neuromuscular disturbances of the colon. The roentgen findings are quite characteristic. The large bowel, particularly the descending colon, is intermittently spastic. From time to time, barium may be propelled in rapid fashion through the bowel lumen. The most common finding is abnormal narrowing of a segment of the colon, occurring most often in the descending or sigmoid loop of large bowel. The involved segment may reveal absence of haustral markings, or residual haustrations producing a "string of pearls" appearance.

The case presented by the author showed the characteristic roentgen findings of an unstable colon and, in addition, a serrated bowel wall. Re-examination eight months later revealed diverticula at the apices of the serrations. The diverticula fall into the classification of false or acquired, inasmuch as the walls were composed of mucosa, which had herniated through the muscular coat, covered by an outer coat composed of the serosa. In contradistinction, the walls of the true or congenital diverticula are composed of all layers of the bowel wall. Acquired or false diverticula occur at middle age or later, and are especially prevalent in the descending and pelvic colon. It is, therefore, conceivable that numerous factors such as constipation, poor bowel hygiene, repeated intestinal trauma, and the unstable colon may precede the development of diverticula in a weakened bowel wall. LOUIS BERNSTEIN, M.D.

Diverticulosis Coli with Coexisting Carcinoma of the Rectosigmoid. A Report of Two Cases. Benjamin G. Oren. South. M. J. **40:** 304–308, April 1947.

Two cases of coexisting carcinoma of the sigmoid were encountered among 102 cases of diverticulosis proved by x-ray. A study of the literature and experiences of other workers indicate that the simultaneous presence of carcinoma and diverticulosis in the same bowel is probably a matter of chance, there being no proof of existence of the origin of carcinoma from a diverticulum.

The author's first patient was a 58-year-old white man with symptoms and signs suggestive of a diverticulitis in the lower descending and sigmoid colon. Under therapy the acute manifestations disappeared quickly. A barium enema then revealed numerous diverticula in the pelvic and descending colon. An obstructive lesion was found in the descending colon in its lower portion. Barium was forced past the constricted area with considerable difficulty. The films showed irregular negative shadows giving the impression of either a new growth or a pericolitis resulting from diverticulitis. Follow-up barium enema studies for a period of several weeks showed no change in the obstructive lesion. At surgery an inoperable carcinoma of the descending colon was found. Diverticula and carcinoma were verified microscopically.

The second patient was a 72-year-old white woman with clinical evidence of diverticulitis and progressive constipation. Repeated sigmoidoscopies were noncontributory because of spasm, which prevented visualization of the region. Earlier x-ray studies had shown diverticula in the distal colon. A barium enema now revealed a constricting defect in the descending colon characteristic of neoplastic involvement. The lesion was removed surgically and carcinoma as well as diverticula was verified microscopically. There was no indication that the tumor had arisen in or from a diverticulum.

The author discusses the clinical features and differential points between diverticulitis and carcinoma of the colon, indicating that differentiation is often a difficult problem indeed. When sigmoidoscopy is impractical it is frequently up to the roentgenologist to make the distinction. A table of differential features, including the clinical picture with sigmoidoscopic findings and roentgen aspects, is given. Bleeding taken as a separate diagnostic point was not found to be of very much significance.

In conclusion, the author states that carcinoma of the colon in association with diverticulosis, although relatively rare, is a frequent enough occurrence that the possibility should ever be kept in mind.

WILLIS MANGES, M.D.

Nontumid Ileocolic Intussusception in an Adult. Report of a Case with Cecal Ulcer. Lester Blum. Surg. Clin. North America **27:** 355–360, April 1947.

A review of the literature is given and the very low frequency of intussusception unassociated with tumor is demonstrated. The accepted theories for the production of intussusception of this type are: (1) that the ileocecal valve normally projects through the wall of the cecum, so that a telescoping of the ileum into the large bowel may occur during discharge of intestinal contents, with the production of an intussusception in the presence of deranged intestinal rhythm; (2) that the base of the appendix, due to a local inflammatory process, may act as a similar point of drag for the adjacent ileocecal valve; (3) that lymphoid tissue aggregates (Peyer's patches) may swell and act as intramural tumors, leading to intussusception; (4) that the slope of the mesentery, at the angle at which it joins the ileum, is a significant factor, especially in infants of the male sex; (5) that the mesentery may be unusually long and the peritoneal attachment of the ascending portion of the colon may be unusually lax. None of these theories is said to possess any foundation in fact. The author presents another postulate, which he describes as equally unproved but equally logical. He assumes the presence of a protective sympathetic mechanism which would tend to release any spontaneous invaginations along the intestinal tract, but with a weak point at the ileocecal junction because of the transition at that site from the vagal to the sacral parasympathetic innervation.

A case is reported in which intussusception began proximal to the site of a non-specific cecal ulcer. The only conceivable part that that lesion played in the mechanism of invagination was that of an irritant which may have disturbed the rhythm as well as increased the force of peristalsis. SYDNEY F. THOMAS, M.D.

Oral Cholecystography with Priodax: Correlation with Pathologic Findings. J. L. Jarvis and David Cayer. Gastroenterology **8:** 461–466, April 1947.

This is a review of 80 cases which came to operation following cholecystography with priodax. The x-ray and pathological findings are compared in a group of tables. It was found that where the concentration of

the dye in the gallbladder was normal, stones were present in all cases in which they were diagnosed cholecystographically with a single exception. In that case the patient had an attack of colic just prior to surgery and it was felt that the calculus must have passed.

Where only faint visualization was obtained, a definite diagnosis of cholelithiasis was made in 19 cases and in all was proved at operation. On the other hand, 3 patients were found to have calculi that did not show on the films.

In the group in which no visualization was obtained, all showed definite evidence of disease, and 29 of the 33 patients had calculi. SYDNEY F. THOMAS, M.D.

Pancreatic Reflux Deliberately Produced. Henry Doubilet. Surg., Gynec. & Obst. **84:** 710–715, April 15, 1947.

Methods are described by which pancreatic reflux with visualization of the pancreatic duct can be produced during cholangiography with iodized oil. The methods also permit biochemical analysis of the material from the drainage tube in the biliary tract.

The importance of biliary-pancreatic reflux as an etiological factor in the production of acute pancreatitis or acute cholecystitis has been demonstrated by numerous writers in recent years.

In the past, pancreatic reflux was demonstrated in about 25 per cent of patients in whom a tube was placed in the biliary tract at operation. The diagnosis was based on two methods: (1) the finding of pancreatic enzymes (notably amylase) in high concentration in the bile recovered from the tube drainage and (2) the visualization of the pancreatic duct when iodized oil was injected into the tube draining the biliary tract. These observations, however, frequently depended on a fortuitous conjunction of events. As a rule, pancreatic enzymes could be found in the biliary drainage only occasionally, usually after meals, but sometimes only in samples obtained late at night. Similarly, the pancreatic duct could be visualized during the performance of a cholangiogram only during such accidental periods when the pancreas was not secreting and when, in addition, the sphincter of Oddi was sufficiently spastic to permit the reflux of iodized oil.

One method described in the present study is as follows: Since two main factors, food and hydrochloric acid, stimulate the secretion of pancreatic juice, the patient is fasted and a Levine tube is passed two hours prior to x-ray examination, for continuous suction of the stomach contents. To control the resistance of the sphincter of Oddi, morphine, 1/6 grain, is given one hour prior to cholangiographic study. In one hour after morphine the spastic effect of the drug on the duodenum has worn off and the resistance of the sphincter falls to about 200 mm. of water (normal 150 mm.). When iodized oil is injected into the common bile duct under such conditions, the whole pancreatic duct can be visualized.

MARLYN W. MILLER, M.D.

THE MUSCULOSKELETAL SYSTEM

Differential Diagnosis of Adult Rheumatic Fever and Rheumatoid Arthritis. Ephraim P. Engleman. California Med. **66:** 227–230, April 1947.

A differential diagnosis between adult rheumatic fever and rheumatoid arthritis is not easy. At least 10 per cent of the patients admitted to army medical centers for rheumatic fever were later found to have chronic joint disease similar to rheumatoid arthritis. Most authorities are of the opinion that such cases are actually acute "atypical" forms of arthritis which recur and merge eventually into the more characteristic clinical picture of a true rheumatoid arthritis.

A study was made of a group of 252 patients with rheumatic fever, with evidence of carditis, either permanent or transitory and 33 rheumatoid arthritic cases, with definite roentgen evidence of joint involvement. The patients of this latter group were admitted with a diagnosis of rheumatic fever and later were found to have an "atypical" rheumatoid arthritis. All patients were observed for a period of six to fifteen months.

The author summarizes the differential features between the two conditions as follows:

1. Carditis, when present, usually indicates rheumatic fever although not necessarily so.
2. The arthritis of atypical rheumatoid disease is apt to be progressive and not migratory, while in adult rheumatic fever it may be either progressive or migratory.
3. The progression of the arthritis may be slower in rheumatoid disease than in rheumatic fever.
4. Unlike rheumatic fever, the antecedent upper respiratory infection is infrequent in rheumatoid arthritis, and when it does occur the latent period is usually significantly shorter.
5. The therapeutic ineffectiveness of salicylates and their failure to halt further progression characterizes their action in rheumatoid arthritis. In rheumatic fever, the objective improvement is dramatic with the proper administration of the salicylates, which exert an equally effective prophylaxis against recrudescences of frank arthritis.
6. Erythema, purpura, and signs of pulmonary or pleural involvement should favor the diagnosis of rheumatic fever.
7. The elevated sedimentation rate of rheumatoid arthritis continues for a prolonged period, while in most cases of rheumatic fever it is of comparatively short duration.

Roentgen findings in rheumatic fever, except for transient osteoporosis, were essentially negative. In rheumatoid arthritis, the changes were chiefly demineralization and joint narrowing. In 39 per cent of the arthritic group, the sacroiliac joints were involved, indicative of early Marie-Strümpell's disease.

MAURICE D. SACHS, M.D.

Arthritis Mutilans ("Main et doigt en lorgnette"). Børge Nielsen and Egill Snorrason. Acta radiol. **27:** 607–616, Dec. 20, 1946.

In 1913 Marie and Léri described the deformity occurring in severe ankylosing polyarthritis which is characterized by atrophy of the heads of the phalanges and metacarpals allowing dislocations with a telescoping of the bones at the joints. The gross appearance is that of shortening of the fingers, with looseness of the joints and thick transverse folds of skin at the site of dislocations. Similar changes have been noted in the feet and at times in a single digit. Since the original report a number of cases have been described, but not all have been associated with long-standing ankylosing arthritis. The authors have reviewed the literature and add 6 cases, 4 of which they report in detail with the roentgen findings. They feel that the term should not be applied to the similar deformity which may occur in certain of the neurological diseases, so-called psoriatic arthritis,

thrombo-angiitis obliterans, hematoporphyrinuria, and scleroderma. ELIZABETH A. CLARK, M.D.

Juvenile Osteopetrosis. Metabolic Studies in Two Cases and Further Observations on the Composition of the Bone in This Disease. J. B. Pincus, I. F. Gittleman, and B. Kramer. Am. J. Dis Child. **73:** 458–472, April 1947.

There are two schools of thought about the cause of juvenile osteopetrosis. According to one, it is a developmental anomaly; the other regards it as a metabolic derangement caused by hyperfunction of the parathyroid glands. The authors report two cases which were subjected to carefully controlled metabolic studies. Both infants also had rickets. One child was studied for one month. The other was observed for sixteen months and then came to autopsy.

The authors believe that they could dissociate the metabolic disturbances due to rickets from those due to juvenile osteopetrosis. After giving large amounts of vitamin D for five months, they obtained a normal blood calcium and phosphorus in one child. They contend that the fact that 80 per cent of the phosphorus excreted was lost by way of the urinary tract was not due to the associated rickets. Absorption of calcium and phosphorus from the gastro-intestinal tract was normal. The Hamilton and Schwartz test for parathyroid hormone in the blood did not reveal an increased amount of this hormone. However, the existence of hyperparathyroidism would explain the large urinary excretion of phosphorus. The authors also found a persistent hypophosphatemia. They conclude that, while a congenital malformation may exist in juvenile osteopetrosis, there is an associated metabolic disturbance resembling a chronic state of hyperparathyroidism.

An analysis of the bone tissue of one case is given, showing a high ash content per unit of dry fat-free bone, a lowered ratio of organic matter to inorganic, and a lowered ratio of tertiary calcium phosphate to calcium carbonate.

Roentgenograms of the two patients are reproduced.

PAUL ROMAN, M.D.

Hypervitaminosis A. John A. Toomey and Russell A. Morissette. Am. J. Dis. Child. **73:** 473–479, April 1947.

In this era of multiplicity of vitamin products and high-powered advertising, it is to be expected that an over-conscientious mother will occasionally hypersaturate her offspring. The authors present such a case with the following findings: hepatomegaly, sparse coarse hair, increased levels of vitamin A in the serum, increased serum lipids, increased serum phosphatase, low serum proteins, abnormalities of bones, with pain and localized periosteal swellings, and prompt recovery after exclusion of vitamin A from the diet.

Roentgenograms of the long bones showed broad growth lines at the ends of all the long bones, stippling of the distal femoral epiphyses, fragmentation of distal fibular epiphyses, a periosteal line along the lateral aspects of the right femur and left tibia, and pronounced periosteal thickening on the posterior and medial aspects of the ulnar bones.

With the mother's permission, the child was put on a high intake of vitamins A and D in one experiment and on a high intake of vitamin A alone in a second experiment, and in each instance the former clinical and laboratory picture was reproduced. The authors conclude that the occurrence of hypervitaminosis A is uncommon and that perhaps some effect is due to the vitamin D. However, they feel that the syndrome is due mainly to hypervitaminosis A.

PAUL W. ROMAN, M.D.

Renal Osteitis Fibrosa Superimposed on Senile Osteoporosis. Report of a Case Without Parathyroid Hyperplasia and With Ureteritis Cystica. George W. Cottrell. J. Bone & Joint Surg. **29:** 491–503, April 1947.

The bone changes in children with chronic renal insufficiency are quite well known but not so well known are the changes that occur in like conditions in the adult. Hyperparathyroid hyperplasia has been found in these cases in both children and adults.

This case report concerns a white female of 75 years who complained of pain in the right hip, lower thoracic vertebrae, and right hand. Roentgenographic examination showed no fractures but marked osteoporosis of the bone, with rarefaction of the tibia and humerus, and pseudocystic changes. Autopsy revealed ureteritis cystica. The bones were soft with many cystic dilatations and thinning of the cortex. The parathyroid glands were not of uniform structure but contained a moderate amount of fat with thickening and hyalinization in the glands. Chief cells predominated, and islands of dark oxyphilic cells were present. No evidence of hyperplasia of any of the parathyroid glands was found. Microscopically the bone structure showed osteitis fibrosa. Marked arteriosclerosis was seen.

In the discussion of the case the author states that bone changes in renal osteitis fibrosis in the adult are indistinguishable from those of hyperparathyroidism. On the basis of accumulated observations it seems logical at present to assume that, when there is evidence of chronic renal insufficiency in the absence of primary parathyroid disorder, histologic signs of osteitis fibrosa, however slight, are attributable to the kidney disease. In the present case, however, though the primary features of osteitis were present, they were of limited extent, and senile osteoporosis was the predominant finding. It is suggested that, in a senile individual in whom there is atrophy of most of the tissues, the addition of another factor favoring decalcification must be reflected in the bones to a much greater extent than would be the case in a person whose skeleton was more normally calcified. JOHN B. MCANENY, M.D.

Chondrodystrophia Calcificans Congenita. Report of Two Cases. Theodore H. Vinke and F. Paul Duffy. J. Bone & Joint Surg. **29:** 509–514, April 1947.

Chondrodystrophia calcificans congenita is a condition characterized by multiple calcareous opacities in the cartilage of the epiphyses. This condition is also known as stippled epiphyses and is supposed to be a form of chondrodystrophy or achondroplasia. The diagnosis is made only by roentgenographic examination. Some patients have been known to have congenital cataracts and other congenital abnormalities. Nine previous cases of this condition have been described in the literature.

The authors' first case is that of a two-month-old white girl showing bilateral congenital calcaneovalgus deformity. The feet were everted, flat, and broad across the tarsal regions, with marked abduction and pronation of the forefoot. Roentgenographic examina-

tion showed small punctate foci of calcification in the region where the tarsal bones should be developing. The wrists showed similar multiple punctate calcifications, without definite organization of carpal bones.

The second patient was a boy, two years and eleven months of age, a brother of the first patient. No abnormalities were found in this case except mild pronation of the feet with medial prominence of the tarsal region. Roentgenographic examination showed very small punctate calcifications in the tarsal region but the tarsal bones themselves were well formed and reasonably normal. JOHN B. MCANENY, M.D.

Hypertrophic Pulmonary Osteoarthropathy. Charles Gottlieb, Herbert S. Sharlin, and Harold Feld. J. Pediat. **30:** 462–467, April 1947.

To the few accounts of hypertrophic pulmonary osteoarthropathy in children recorded in the literature, the authors add a case associated with chronic pyopneumothorax in a 2-year-old girl. Roentgenograms of the chest and of the upper and lower extremities are reproduced. The patient was referred to another hospital for special thoracic surgery, and the final outcome is not stated. A brief review of the literature is included.

Fracture of the Carpal Scaphoid. Mather Cleveland. Surg., Gynec. & Obst. **84:** 769–771, April 15, 1947.

The carpal scaphoid is a frequent site of fracture in young adults. The fracture generally occurs through the "waist" of the bone, and the blood supply of the proximal fragment may be impaired. The fractures are caused by indirect violence transmitted from the outstretched hand.

The frequent use of roentgenograms in wrist injuries occurring in the armed services led to the discovery of an enormous number of fractures of the carpal scaphoid. The author recommends two views as showing the fracture best: anteroposterior, with the hand in marked ulnar deviation, and postero-anterior in a 45-degree angle oblique projection. The fracture line may occasionally not be shown even with these views at the first examination, but will be apparent on re-examination two weeks later, after absorption along the fracture line has occurred. An avascular proximal fragment is shown only after an interval of time, when the regional bones atrophy, leaving the proximal fragment with a relatively increased density.

Treatment is by immobilization in a circular plaster splint including the entire thumb but leaving the fingers free. Healing occurs in eight to ten weeks when there is no interference with the blood supply to the proximal fragment. JOHN A. COCKE, M.D.

March Fractures. A Study with Special Reference to Etiological Factors. James G. Donald and William T. Fitts, Jr. J. Bone & Joint Surg. **29:** 297–300, April 1947.

This is a comparative study of two different groups of soldiers, of about equal numbers, marching over similar country for like distances, one with marked conditioning, the other with comparatively little conditioning for extensive marches. In the well conditioned group only 2 march fractures were found, while in the poorly prepared soldiers 60 cases occurred.

Proper conditioning of soldiers to marching, together with structurally strong feet and ankles, appeared to be the chief factor in prevention of march fractures. An interesting note is made that fractures never occurred in Chinese soldiers subject to the same march and under the same conditions. JOHN B. MCANENY, M.D.

Some Experiences with Bone Tumours. James F. Brailsford. Brit. J. Radiol. **20:** 129–144, April 1947. (Abridgment in Proc. Roy. Soc. Med. **40:** 787–794, November 1947.)

Brailsford presents an abstract of the histories and roentgen findings in 10 cases of bone tumors, some malignant, some benign, having unusual diagnostic features or unexpected developments. Each illustrates some problem in diagnosis or prognosis.

These cases demonstrate that the differential diagnosis between osteomyelitis, tumor, and syphilis is not always easy. Full advantage should be taken of clinical observations, especially when either x-ray or early clinical evidence is indefinite. Biopsy is sometimes misleading. Amputation should not be done hastily.

SYDNEY J. HAWLEY, M.D.

Solitary Eosinophilic Granuloma of Rib. Case Report. B. G. P. Shafiroff and L. Scheman. Ann. Surg. **125:** 510–512, April 1947.

A case of eosinophilic granuloma of the 6th rib in a 31-year-old male is reported. Repeated roentgen studies showed a slowly progressive destructive process with eventual periosteal reaction, some bony condensation, and fracture. No similar lesion was demonstrable elsewhere in the skeleton, and studies of the gastrointestinal, genito-urinary, and respiratory tracts showed no evidence of a primary malignant growth. Approximately three months after the onset of symptoms, the involved area of the rib was resected. A roentgenogram and photomicrograph are reproduced.

Osteoid Osteoma Associated with Changes in Adjacent Joint. Report of Two Cases. Mary S. Sherman. J. Bone & Joint Surg. **29:** 483–490, April 1947.

This paper is concerned with the hypertrophic arthritic change that often occurs in joints that are adjacent to a focus of osteoid osteoma.

The first of the author's two patients was a 16-year-old girl with pain and restricted motion in the right hip. Films showed two oval areas of decreased density on the medial aspect of the femoral neck. There were mild degenerative changes in the hip with narrowing of the joint space and lipping of the margin of the femoral head. At operation the synovial membrane showed definite proliferation and the joint space contained about 100 c.c. of fluid. There was marked osteophyte formation about the head. The bone lesions in the femoral neck were removed. The pain was relieved immediately but the joint limitation continued, being attributed to the hypertrophic arthritic change. The material removed from the femoral neck proved to be osteoid tissue.

The second patient was a 13-year-old boy with pain in his left elbow accompanied by limitation of motion. Fluid was aspirated from the joint on several occasions. X-ray examination showed thickening of the cortex of the lower end of the humerus and irregularity of the ossification center of the trochlea. Five months later a definite change was demonstrable roentgenographically in the olecranon fossa, which was

completely occupied by a rounded lesion with a center of mottled increased density. The lower end of the humerus was thickened by new bone formation and there was some loss of the normal contour. At operation the olecranon fossa was completely cleaned out and the tissue proved to be of osteoid nature. Biopsy of the thickened synovial membrane suggested chronic inflammatory change.

In the discussion of these cases the author states that it is not unusual to find joint changes accompanying lesions in the adjacent bone structure. After removal of the bone lesion the inflammatory change in the joint persists for some time and often permanent damage remains. JOHN B. MCANENY, M.D.

Icterus Gravis of Pregnancy and Symmetrical Spontaneous Fractures (Milkman's Syndrome). D. Stucki. Schweiz. med. Wchnschr. **77:** 398–404, April 5, 1947.

Milkman's disease consists of multiple spontaneous fractures without accompanying osteoporosis, with no tendency to callus formation, and extraordinarily resistant to treatment. Herold (Helvet. med. acta. supp. 13, 1944) showed that the typical zones of reconstruction (Looser's *Umbauzonen*) are pseudo-defects composed of bands of osteoid tissue, which because of their transparency to x-ray, produce the appearance of fractures. They are found only in osteomalacia and rickets and are due to a D avitaminosis. Pseudo-zones of reconstruction, seen in senile osteoporosis, v. Recklinghausen's disease, multiple myeloma, thyrotoxicosis, Paget's disease, osteopsathyrosis, etc., are true anatomical defects secondary to osteoporosis. The symmetrical localization is due to anatomic factors. Early diagnosis depends on elevation of the serum phosphatase.

The finding of this condition in pregnancy is unusual; it has been reported as occurring secondary to puerperal osteomalacia. An interesting feature in the case here reported (in great detail) is the relation of the liver to the disease; the author believes that it adds support to the conception of hepatogenic osteopathy described by others. The patient was a 39-year-old primipara who was first seen at the sixth month of gestation because of an icterus gravis. Radiographs showed zones of reconstruction in the posterior arcs of both tenth ribs, which healed in about six weeks under vitamin D treatment. The general condition followed a stormy course. A live child was born about two months prematurely. Eventual recovery with residual liver damage ensued.

The author emphasizes four factors in the development of this condition: a hepatic factor, due to the disturbance of practically all forms of metabolism in the face of relative hepatic insufficiency; an endocrine factor, not completely understood, but having to do with poor regulation of the basophil cells of the pituitary, the thyroid, and the parathyroids; a lack of vitamin D; and finally, a mechanical factor, accounting, on the basis of similar stresses, for the symmetry of the fractures. Treatment is by administration of vitamin D in enormous doses. Therapy directed to hepatic disease, where this is present, is also indicated.

LEWIS G. JACOBS, M.D.

The Disc Factor in Low-Back Pain With or Without Sciatica. J. Grafton Love. J. Bone & Joint Surg. **29:** 438–447, April 1947.

A careful history is of great value in patients suffering with low-back pain with or without sciatica. The injury, to which the trouble is most often traced, may be trivial and only slightly incapacitating. Usually, however, there are recurrent attacks of pain in the gluteal region or down the course of the sciatic nerve. Rest in bed may relieve the pain but in about 25 per cent of the patients night pain is severe enough to awaken the patient and make him sit up and walk about to obtain relief.

If the fragmented disk protrudes in the mid-line there may be no sciatic pain or scoliosis. If the fragment is small and shifts from side to side, there may be alternating scoliosis without sciatic pain. If, however, the mid-line protrusion is large there is usually backache with alternating scoliosis and sciatic pain. Lateral protrusion of the disk fragment may not cause true sciatic pain until late, which the author believes is due to stretching of the posterior longitudinal ligament. When the posterior longitudinal ligament is broken through and the fragmented cartilage actually comes into contact with the nerve root, the pain is similar to that encountered in neoplastic compression. Irritation of the nerve root may also occur without rupture of the longitudinal ligament, resulting in edema and enlargement of the root with adhesions to the surrounding structures. After the stage of nerve-root irritation, the ligamentum flavum may become thickened as a result of altered body mechanics and this may cause further compression of the root.

Physical examination will usually show loss of the normal lumbar lordosis with spasm of the erector spinae muscles. The motion of the lower back may be limited, and hyperextension may be very painful. Local tenderness is sometimes encountered. Neurologic examination will show change in the Achilles reflex and sometimes in the sensory dermatome. In severe cases, atrophy of the calf muscles may occur. It is the author's belief that the protruded disks cannot be localized by neurological methods alone.

Roentgen studies include plain films of the back, chiefly to rule out simulating conditions. For myelography the author uses air but believes that lipiodol gives the most accurate results, in experienced hands. Pantopaque he regards as of less value but somewhat better than air. Both pantopaque and lipiodol should be removed after examination.

In about two-thirds of the cases of protruded disks, the protein content of the spinal fluid will be about 40 mg. or more per 100 c.c. Rarely will subarachnoid block occur with protruded disks.

The various conditions that enter into the differential diagnosis of low-back pain besides intervertebral disk lesions are hypertrophic arthritis, spondylolisthesis, spondylolysis, old fractures and dislocations, tumors of the spinal cord and nerve roots, metastatic bone lesions, tuberculosis, and thickening of the ligamentum flavum. JOHN B. MCANENY, M.D.

One Hundred Cases of Sciatica: Contribution to Diagnosis and Therapy. Paul Rosselet. Schweiz. med. Wchnschr. **77:** 299–309, March 8, 1947.

For this study of sciatica, 100 examples were chosen at random from cases either severe in intensity or exceeding thirty days in duration. Thirty-two patients were operated upon; 35 per cent of these and 50 per cent of those not operated upon had a previous history of lumbago or sciatic pain. In half of the operated cases there was a history of trauma. The patient often

blamed exposure to cold or inclement weather for the onset or recurrence of his pain. Subjective complaints were varied. An increase of pain on coughing was noted by 48 patients. On inspection, a pain-relieving posture, scolioses, segmental rigidity, muscle spasm, or atrophy may be noted. Direct pressure on the apophysis does not give much information, but pressure in the direction of the ground with the patient bent forward slightly may reproduce the pain. Lasègue's sign was generally positive, and other neurologic manifestations were common. The chief radiologic findings are summarized as follows:

	Operated (32)	Non-operated (68)
Narrowing of disk L5/S1	20	49
Narrowing of adjacent disk	6	15
Spondylarthrosis	18	59
Dorsal dislocation	8	14
Pain-relieving posture	7	7
Lumbar scoliosis	6	16
Sacrum arcuatum	4	11

Other findings are listed as ventral dislocation (L5), lateral dislocation (L5), sacrum acutum, spina bifida, spondylolisthesis, spondylolysis, sacralization, Scheuermann [Scheuermann's kyphosis?], Schmorl's node, six lumbar vertebrae, osteoporosis, sclerosis of disk, wedge vertebrae, calcification of disk, asymmetrical tropism of sacroiliacs. The marked frequency of disk narrowing is noteworthy. Asymmetry of the intervertebral joints should not be forgotton as a cause for sciatica.

Lumbar puncture was done in 31 patients. In 23 the albumin was elevated.

Myelography has sufficient complications to limit its use to certain well defined conditions, as when immediate operation will permit removal of the oil or when a positive diagnosis must be made. Of 2 patients in this series in whom lipiodol was injected but who were not operated upon, one developed a polyradiculitis with total disability. In skillful hands oxygen myelography may sometimes give satisfactory results. Pantopaque is still under study in Switzerland; its use, if the results equal those reported by American authors, would seem to be the solution to this problem.

Conservative treatment not infrequently gives a favorable and more or less lasting result. Salicylates, vaccines, physiotherapy, x-ray therapy, balneotherapy, and orthopedic appliances are all useful in selected cases. The majority of patients, however, do not obtain adequate relief. Laminectomy, with exploration of at least the two adjacent disks if the first studied does not seem diseased, is the most successful treatment. This should sometimes be supplemented by an Albee graft. The 31 laminectomies in this series showed 14 true disk hernias, 1 neurinoma of the cauda equina, 4 marked hypertrophy of the ligamentum flavum, 6 probably hypertrophy, and 3 lipid degeneration. Of the 14 true herniations, 10 were cured, 2 of the patients became symptomless but with diminished working capacity, and 1 was improved. Of the entire group, 95 per cent were cured symptomatically, but 40 per cent had some residual loss of working ability, although this loss was lessened by the operation. Since the vast majority of sciaticas are diskal or vertebral in origin, operation is indicated in all severe or persistent cases in which conservative measures fail after a trial of two to three months.

LEWIS G. JACOBS, M.D.

Lesion of the Intervertebral Disk Caused by Lumbar Puncture. Alfreda H. Baker. Brit. J. Surg. **34:** 385–388, April 1947.

A case is described in which diagnostic lumbar puncture in a child was followed within a few days by severe backache and rigidity of the spine. Radiographs demonstrated the rapid development of prolapse of the intervertebral disks. Treatment by spinal support was successful. The etiology of the lesion is discussed. Excellent roentgenograms are reproduced.

Vertebra Plana in Lipoidosis (Hand-Schüller-Christian). A Contribution to the Etiology of Aseptic Necrosis of Bone. Johan Torgersen. Acta radiol. **27:** 638–642, Dec. 20, 1946.

Vertebra plana of the eighth thoracic vertebra is reported in a three-and-one-half-year-old child who had other findings of Hand-Schüller-Christian disease. Since vertebra plana has always been considered as an aseptic necrosis, a possible link between the metabolic disturbances, such as the lipoidoses, with endocrine diseases, especially in association with congenital malformations, is discussed.

ELIZABETH A. CLARK, M.D.

Primary Lymphangioma of the Ilium. Report of a Case. William H. Bickel and Albert C. Broders. J. Bone & Joint Surg. **29:** 517–522, April 1947.

A five-year-old girl was thought to have had an osteomyelitis of the left ilium causing pain in the left hip and a limp, with shortening of the left leg. Roentgen examination showed almost complete absence of the left ilium from the sacroiliac joint to the acetabular region, with medial displacement of the remaining portion of the left pelvis and proximal femur. An earlier examination had shown a destructive process in the region of the left sacroiliac joint involving the medial aspect of the ilium and the lateral aspect of the sacrum. Biopsy was done and a report of lymphangioma of the left ilium infiltrating the soft tissue and muscle was made. Roentgen therapy was attempted, but the process continued to spread and it was decided that the growth was radioresistant. Irradiation was then discontinued. Progress films showed extension of the growth, involving the left side of the sacrum, the facets of the lower lumbar vertebrae, with questionable involvement of the proximal femur.

JOHN B. MCANENY, M.D.

A Report on Four Cases of Congenital Genu Recurvatum Occurring in One Family. Aubrey L. McFarlane. Brit. J. Surg. **34:** 388–391, April 1947.

Genu recurvatum, or congenital dislocation of the knee, consists of a fixed hyperextension of the leg at the knee joint, often in association with other congenital abnormalities, especially clubfoot and congenital dislocation of the hip. Usually the patella remains undeveloped until the deformity is corrected surgically and normal functional stresses are restored.

The author's series consists of 4 cases, in a colored woman and her 3 children. All the children had different fathers and none of the fathers had any congenital abnormality. All the grandparents were normal as far as could be ascertained. The first patient was a girl aged ten months, with bilateral congenital genu recurvation. Reduction was accomplished by open operation. When the child was last seen, eight years later, the

joints showed normal function and range of motion. The second patient was a boy of seventeen months having other congenital abnormalities. Both knees were operated on successfully and after two years he had normal range of movement. The third child, a girl, was seen at 3 with bilateral genu recurvation and severe gastroenteritis. The x-ray films showed the typical deformity and the infant died before treatment could be given. The mother, 27 years old, had untreated bilateral genu recurvation. X-ray films showed complete posterior dislocation of the femur at the knee joint. The patellae were well developed, even though the normal stresses were altered and the deformity remained uncorrected. MAX CLIMAN, M.D.

GYNECOLOGY AND OBSTETRICS

Standardised Radiological Pelvimetry. III. A New Method of Measuring the Outlet. E. Peter Allen. Brit. J. Radiol. **20:** 164–169, April 1947.

This is the third of a series of papers, of which the first two were abstracted in the preceding issue of Radiology (**50:** 137, January 1948).

Measurement of the outlet is relatively neglected in pelvimetry; yet it is of particular importance because clinical measurement is subject to major errors. Disproportion at the inlet is quite readily discovered as the fetal head is present to act as a pelvimeter. Unexpected arrest at the outlet may be disastrous for mother and child.

The pelvic outlet consists of two triangular planes resting on a common base, in other words, it is lozenge shaped and bent so that it lies in two planes. Usually measurements of the outlet consist of an estimation of the subpubic angle and measurements of the posterior sagittal and intertuberous diameters. These are not entirely satisfactory because disproportion may be present with a wide subpubic angle and a short posterior sagittal, and accurate correlation is difficult.

The author suggests determining the "symphysis-biparietal distance," and a new posterior measurement, called the "available posterior sagittal." The symphysis-biparietal distance is obtained on a film made to measure the subpubic angle, by the application of a specially made transparent template from which the diameter may be directly read. This allows for differences in the shape of the pubic arch. The available posterior sagittal is measured on a lateral film. The symphysis-biparietal distance is enlarged proportionately to compensate for the greater magnification in the lateral view, and this distance is set up on a compass. Using the middle of the lower edge of the symphysis as the center, an arc is described in the region of the ischial tuberosities. The intersection of this arc on the inferior and posterior surface of the tuberosities is the anterior end-point of the available posterior sagittal. The sacral tip is the posterior end-point.

This procedure is not easy even with good films. The author compares it with the use of the subpubic angle and the available posterior sagittal of the outlet. The latter method allows a reasonably certain prognosis of normal or abnormal delivery in seventy cases in a hundred. Use of the subpubic angle allows a positive prognosis in one case in a hundred and the symphysis-biparietal distance gives the answer in three cases in a hundred.

SYDNEY J. HAWLEY, M.D.

THE GENITO-URINARY SYSTEM

Pyeloscopy. An Evaluation of the Method. Hans Salinger and Fritz Saalberg. Acta radiol. **27:** 617–637, Dec. 20, 1946.

For technical reasons, intravenous and retrograde pyelography do not always give conclusive findings either concerning morphological or physiological abnormalities of the kidneys and ureters. Pyeloscopy, however, which combines retrograde filling with fluoroscopic observation provides the opportunity for complete filling with contrast media, for accurate knowledge of the constancy of any defect, for controlled roentgenography for permanent records, and for observation of the dynamic action of the musculature of the upper urinary tract. The danger of overfilling, as well as the associated discomfort to the patient, is overcome. By means of a belt and compression bladder the patient may be rotated, and the kidney pelvis and calices may then be observed in three dimensions, as well as during respiration and the phases of emptying.

Exposure of the examiner to scattered radiations is minimized when small "spot films" are used. Although the method is time-consuming, the improved accuracy of observation reduces the necessity for repeated examinations. Furthermore, there is economy in the number of films required for adequate examination. The authors feel that pyeloscopy offers a supplementary method to intravenous pyelography and that it is essential to observe retrograde filling if the best results are to be obtained.

Cases are reported. ELIZABETH A. CLARK, M.D.

A Pyelographic Test for Renal Fixity During Respiration. Francisco Martino Savino. Brit. J. Urol. **19:** 29–31, March 1947.

The author describes a sign which in conjunction with lumbar pain, leukocytosis, and hyperthermia is pathognomonic of such conditions as perinephritic abscess and acute non-suppurative lesions, as renal carbuncle and cortical renal furuncle. Two x-ray films are taken with both ureters injected for urography: first, an ordinary pyelogram made with the patient holding his breath, followed at once by an exposure during which the patient breathes (the number of respirations should be from two to five). In these circumstances a kidney that is the seat of an acute perinephritis presents a pelvic shadow equally defined in both exposures. On the other hand, the pelvic shadow of a sound and mobile kidney will be clear-cut only in the first pyelogram, while in the second it is markedly blurred because of movement with respiration.

Renal immobility springs from two factors—muscular and renal. The muscular component is due to inhibition and contracture of neighboring muscle groups. The renal component is a consequence of inflammation of the renal coverings. With acute perinephritic inflammation leading to abscess, as may occur with renal furuncle and renal carbuncle, both factors are present. During respiration, therefore, the shadow of the renal pelvis on the side of the lesion is as well defined as when the breath is held. The sign is fully positive and becomes positive early. With chronic renal lesions, the muscular component is in abeyance, but some degree of renal fixity exists. Respiratory movement of the kidney shows a certain "laziness." This "laziness" is due to chronic perinephritis that goes with lesions such as renal tubercle, pyonephrosis, and renal neoplasm. With

renal neoplasms a fully positive sign is evidence that the tumor has broken through its capsule and become inoperably fixed by invading the muscles. In juxtarenal lesions (Pott's disease, psoasitis, or lumbo-abdominal myositis), the muscular component is present, but so long as the diaphragm, which is the prime force in the movement of the kidney, is not involved, the shadow shifts with respiration and blurs the pelvic outline sufficiently to make the sign completely negative.

Solitary Ectopic Pelvic Kidney, with Reports of Two Further Cases. Howard G. Hanley and W. Arklay Steel. Brit. J. Surgery. **34:** 402–407, April 1947.

Two cases of solitary ectopic kidney are added to the 42 cases reported in the literature up to May 1946. The first patient was a man aged 43, who had dysuria and hematuria for one month. The plain radiograph showed no renal outlines but there were several small opacities overlying the sacral area. Excretion uropathy demonstrated a solitary pelvic kidney with a calculus impacted at the lower end of ureter. The stone was removed surgically and the kidney was found on the posterior wall of the pelvis. No attempt was made to remove the renal stones.

The second case was in a 9-year-old girl who was operated on for acute appendicitis and pelvic peritonitis. The appendix was found to be normal and exploration revealed complete transposition of all viscera. There was no evidence of vagina, uterus, or fallopian tubes. The renal mass was lying obliquely over the sacral region, and there appeared to be at least three separate pulsating vessels arising from the area of the bifurcation of the aorta and the left common iliac artery. Following a diagnosis of pyelitis, sulfathiazole was administered, with recovery. A chest film later confirmed the dextrocardia and a barium meal confirmed the abdominal transposition. Cystoscopy revealed the absence of the right ureter and right half of the trigone. Excretory pyelography revealed a normally functioning ectopic pelvic kidney. This case illustrates the importance of a urological investigation in any case of congenital lesion of the genital tract in a female. Every solitary ectopic kidney in a female so far reported, has had an associated genital anomaly.

A table of 44 cases of solitary ectopic kidney reported in the literature is appended. MAX CLIMAN, M.D.

Kidney Tumors. A Clinical and Pathological Study with Special Reference to the "Hypernephroid" Tumor. Norman A. Harvey. J. Urol. **57:** 669–692, April 1947.

This study is offered as perhaps a typical experience of an average genito-urinary service in a general hospital of moderate size (600 beds). The author presents a comprehensive review of the literature with emphasis upon the evolution of the presently held theories pertaining to the origin and development of renal neoplasms. Ewing's classification has been employed in this presentation.

Fifty malignant tumors of the kidney and 8 incidental "hypernephroid" tumors were found in the course of 4,529 necropsies and 39,857 surgical operations at the Rhode Island Hospital from 1929 through 1944. Thirty-nine of these were surgical specimens, while the remaining 19 were removed at necropsy.

The "classic" triad of hematuria, pain, and mass was present in 17 per cent of the reported cases. No reversal of the triad, *i.e.*, with the mass appearing first, was observed by the author. (Hematuria and pain were observed in 40 per cent of the cases.) Urinary symptoms (excluding hematuria) were seen initially or early in 40 per cent of the surgical series, the most common being dysuria, frequency, urgency, pain and burning in that order. A concise comprehensive review of clinical symptomatology and laboratory findings is presented.

The importance of an adequate history in arriving at an early diagnosis is stressed. Among other physical signs, reference is made to subcostal vein dilatation brought out on walking or standing. This has been observed in patients with upper pole renal tumors. Metastatic nodules on the skin or bony surfaces may appear early or late in the clinical course of the disease.

Early use of the x-ray offers the best opportunity for detection of these tumors, with life-saving consequences. Intravenous urography may, and often does, obviate the necessity for further more painful procedures. Positive diagnosis was available in 31 per cent of the cases examined by this method. Retrograde pyelography is a more generally reliable procedure for the portrayal of finer detail and in this series produced positive diagnostic results in 54 per cent of the cases examined.

Survey examinations of the lungs and osseous system were routinely performed when a definite diagnosis of renal tumor was made. Metastases were disclosed in 7.3 per cent of patients so examined. This compares with 56 per cent in the autopsied cases in which such antemortem studies were done.

Treatment is primarily surgical. Preoperative irradiation is limited to large fixed tumors where its use might facilitate surgical removal. The presence of metastases is not completely inconsistent with surgery as was formerly believed. A valid contraindication to operation is a large fixed tumor with extensive local infiltration and lymph node involvement. For those cases considered inoperable, irradiation often affords substantial relief from pain and may prolong life. The prognosis in carcinoma of the pelvis is not as favorable as in cortical tumor. The prognosis for Wilms' tumor is worse than that of either epithelial lesion, and the prognosis for sarcoma worst of all.

As to the "hypernephroid" tumor, the author believes this to be a well differentiated neoplasm that can, by virtue of its vascularity and accessibility to the renal vein and inferior vena cava, produce early metastases when it undergoes malignant change.

The bibliography for this report contains 62 references to the American and foreign literature. The report is well illustrated with numerous tables. Comparison statistics from multiple sources are also presented. JOSEPH P. TOMSULA, M.D.

Distant Metastases of Fifty-eight Renal Neoplasms: A Case Report of Secondary Metastatic Pulsations from a Renal Tumor. Brodie C. Nalle, Jr. J. Urol. **57:** 662–668, April 1947.

The author's series of 58 renal tumors excluded renal tumors occurring in the first decade, such as Wilms' tumor and neuroblastomas of children, and included more adult parenchymal and pelvic renal tumors, which were all clinically or microscopically malignant. In addition, a report is presented of a rare case revealing two distinct pulsating metastases from a hypernephroma.

Of a total of 191 symptoms complained of by the 58 patients, only 58 per cent were referable to the genito-urinary system. The remainder were constitutional, or

referable to the gastro-intestinal, cardiovascular, central nervous, and skeletal systems in decreasing order of frequency. The classic triad of hematuria, pain, and mass was most frequent in urologic symptomatology but appeared late in respect to surgical care. In approximately 50 per cent of the cases the triad did not occur at all. In three cases, persistent fever was the only complaint and was unexplained until as a last resort urological studies were undertaken, demonstrating a parenchymal lesion in the kidney.

Renal tumors are often silent and are diagnosed only when clinical evidence and bizarre symptoms point to metastases in the chest, bones, or other organs. In the present series metastases occurred in the chest in 27 cases (44.8 per cent), in the deep organs (liver, brain, adrenals, etc.) in 24 cases (41.4 per cent), in the bones in 11 cases (18.9 per cent), in the lymph nodes in 9 cases (15.5 per cent), in the urinary tract in 8 cases (13.8 per cent), and in the superficial tissues in 6 (10.3 per cent). Metastases were present at the time of original study in 34 per cent of this series.

A case is reported of a 52-year-old male who complained of pain in the left groin of three and a half months' duration brought on by "straining his leg," and of a lump in the left shoulder which had been noted for only two weeks. On examination the mass in the shoulder area was distinctly pulsating in type, and fluoroscopically appeared to be pulsating synchronously with the heart. A similar pulsating mass was palpable in the left groin. Roentgenographic examination revealed complete destruction of the distal 6 cm. of the left clavicle, and an area of destruction of the left side of the pelvis. Further studies, including pyelography, yielded a final clinical diagnosis of malignant hypernephroma with multiple pulsating metastases to the left iliac bone and left clavicle. A review of the literature shows pulsating metastases, particularly multiple pulsating metastases in bone, to be extremely rare.

DAVID S. MALEN, M.D.

Primary Carcinoma of the Ureter. Samuel L. Grossman and Russell E. Allyn. Pennsylvania M. J. **50:** 715–717, April 1947.

Only about 200 proved malignant tumors primary in the ureter have been recorded since the first report of that condition in 1878. The etiology is obscure. Leukoplakia with malignant metamorphism, cell inclusion during embryonic development, inflammatory and mechanical irritation have been suggested as possible factors.

No method of classification of these tumors has as yet been worked out, but for practical purposes they may be divided into papillary and non-papillary types. Metastasis usually occurs early, and the tumor becomes more malignant the closer it is to the bladder. Over half of all tumors of the ureter are in the lower third. Males are affected more often than females in the ratio of two to one. The youngest patient described in the literature was twenty-two years old, the oldest eighty-nine.

The classical triad of symptoms, hematuria, pain, and a mass is usually present, as in other urologic conditions. The pain may be in the nature of a colic due to the passage of clots, or it may be dull and aching, due to pelvic distention. Local or distant metastasis may also cause pain.

All that is usually seen on x-ray examination is a hydronephrosis due to obstruction. Some writers lay great stress on a peculiar resistance encountered to the passage of a catheter and bleeding, but the authors feel that similar findings may occur with congestion around a calculus. Pelviureteroradiography is of paramount importance. A constant filling defect has been said to be the only definite evidence of a ureteral tumor. The authors have found an even more important diagnostic sign, in the case of papillary growths, to be a fusiform or cup-like dilatation below the filling defect. This they attribute to the peristaltic action of the ureter forcing the tumor to a lower level in the ureter. After the passage of the peristaltic wave the tumor recedes, but a dilatation results. Obviously this will not occur with a flat or sessile growth.

The treatment of choice for ureteral carcinoma is complete ureteronephrectomy, with resection of a cuff of bladder tissue. The prognosis is extremely grave, and five-year cures are exceptional.

Two case histories are given. One patient, operated upon in 1937, lived ten years and was said to be free of metastases, though he had hemiplegia during the last years of his life. The other patient was well and free of metastases seven and a half years after operation for a papillary carcinoma, Grade I.

JOSEPH T. DANZER, M.D.

THE BLOOD VESSELS

Cerebral Arteriography. Baudelio Villanueva. Rev. mex. de radiol. y fisioterapia **1:** 3–21, 1947.

This is the principal article in the first issue of the official organ of the revived Mexican Society of Radiology and Physiotherapy, and is typical of the new life which has been injected into radiological groups throughout the new world. The author has related at some length the history of the development of visualization of the cerebral vessels, particularly in Mexico. He concludes that the method is useful in the diagnosis of certain cerebral lesions, principally thrombosis, aneurysms, angiomas, and tumors in general. It is often necessary to combine arteriography with ventriculography or encephalography. With proper technic, good visualization of the cerebral vessels may be obtained in a high percentage of cases.

The author prefers the transcutaneous method to the open method of injecting the carotid artery, though in a small percentage of cases it is necessary to turn to the open method when the closed method has failed. Even though one cannot consider the procedure entirely free from risk, the author has had not a single accident in 20 cases. The radiological factors generally used are 20 ma. sec., with 200 ma., 90 cm. distance, and kilovoltage appropriate to the diameter of the head.

JAMES T. CASE, M.D.

Studies on the Coronary Circulation. II. The Collateral Circulation of the Normal Human Heart by Coronary Perfusion with Radioactive Erythrocytes and Glass Spheres. Myron Prinzmetal, Benjamin Simkin, H. C. Bergman, and H. E. Kruger. Am. Heart J. **33:** 420–442, April 1947.

Two new methods for the study of the collateral circulation of the postmortem human heart are presented in order to gain further information about this circulation in the normal heart. The first method utilizes a saline suspension of erythrocytes labeled with radioactive phosphorus as a perfusion medium which can be detected and measured quantitatively in any area of the

heart. This method has been demonstrated to be very sensitive in that minute quantities of radioactive red cells can easily be measured. Since blood is the normal circulatory fluid, it is preferable to non-physiologic fluids in studies of the circulatory system. After perfusion of radioactive red cells through one of the branches of the left coronary artery in normal hearts, abundant amounts of the labeled erythrocytes were found throughout the left and right ventricles. These findings indicated the existence of numerous anastomoses in the left ventricle and of a collateral circulation between the right and left ventricles in the normal postmortem human heart.

The second method of study consisted of the injection of glass spheres of known size through one of the coronary arteries. The spheres were collected at the opposite coronary artery, the coronary sinus, and the ventricular cavities. In this way the diameters of the various anastomotic channels in the normal heart could be quantitatively measured.

The authors conclude that the normal human heart has an extensive collateral circulation with anastomotic channels of various types. When the need arises, this collateral circulation is ready to function immediately, at which time the anastomotic communications may become enlarged in the presence of a favorable pressure gradient. There is evidence to show that the collateral circulation does function following an acute coronary occlusion, but only in a limited manner.

A Preliminary Study of the Coronary Circulation Post Mortem. A. Harvey Salans and Phyllis Tweed. Am. Heart J. **33:** 477–489, April 1947.

The authors describe a technic for postmortem study of the coronary circulation. A suspension of barium sulfate in an aqueous ammoniated solution of latex rubber is injected, the heart is cooled in a vacuum bottle containing a 95 per cent alcoholic solution of 2 per cent glacial acetic acid and 4 per cent formaldehyde at a temperature of − 13° C., and is then "unrolled" according to the technic of Schlesinger (Am. Heart J. **15:** 528, 1938) so that the entire arterial system is laid out on a single plane. A roentgenogram is then made with the following factors: 38 kv.p., 10 ma., 36 in. distance, 10 seconds, medium cone. An opaque marker is placed in the region of the enucleated septum, with orienting markers to designate the right and left coronary arteries. The technic is so standardized that a wet roentgenogram furnishing a complete two-dimensional visualization of the entire coronary circulation is available in one to one and a half hours after the heart has been removed.

Single Coronary Artery: Case Report of an Absent Right Coronary Artery. E. F. Geever and A. Ravin. Am. J. Obst. & Gynec. **33:** 538–540, April 1947.

The authors report a case in which absence of the right coronary artery was demonstrated radiographically postmortem. The single coronary arterial orifice opened into the left anterior aortic sinus. The artery was injected and the specimen unrolled and radiographed according to the Schlesinger technic (Am. Heart J. **15:** 528, 1938). The place and distribution of the missing artery were taken over by the circumflex branch of the left coronary artery. Instead of terminating in the posterior descending branch, as normally occurs, the circumflex branch continued in the atrioventricular sulcus and supplied all of the right ventricle. Moderate distortion of the large arterial branches due to sclerosis was noted, but the lumens were not occluded at any point. The patient was a woman of sixty-six with pulmonary embolism following operation for carcinoma of the sigmoid.

Inferior Cavography in the Diagnosis of Thrombophlebitis of the Inferior Vena Cava. Agustin Castellanos and Raúl Pereiras. Arch. de med. infant. (Habana) **15:** 98–108, April–June, 1946.

In 1937 the authors devised a technic called superior cavography, designed to study the alterations of the large veins of the mediastinum, and especially of the superior vena cava and of the various branchial trunks. The following year they published their method of inferior cavography. Foster, Brouwer, and Kurtz were the first to apply inferior cavography to the study of thrombosis of the superior vena cava, and thus permit the diagnosis in the living, at least in infants, of thrombophlebitis of the superior vena cava.

JAMES T. CASE, M.D.

Radio-opacification of the Chambers of the Left Heart and of the Aorta and Its Branches (Levo-angiocardiography). Agustin Castellanos, Argelio García López, and Raúl Pereiras. Arch. de med. inf. (Habana) **15:** 67–77, April–June 1946.

Castellanos and his associates are probably the originators of angiocardiography. The method first published by them in 1937 consisted of radio-opacification of the great veins opening into the right auricle (phlebography), of the right auricle and ventricle (cardiography), and of the pulmonary artery and its branches (arteriography). When only the cavities of the right heart are included the authors believe that dextro-angiocardiography is the proper designation, while radio-opacification of the left auricle and ventricle and aorta and its branches should be called levo-angiocardiography. Both dextro- and levo-angiocardiography may be successfully carried out with a single radiopaque injection and serial roentgenograms. The authors have employed angiocardiography in various cases, especially for the diagnosis of defects of the interauricular and interventricular septa. This technic is indicated in those cases in which one suspects interauricular or interventricular communication with higher blood pressure in the left cavities than in the right. There may be obtained practically normal, or nearly normal, dextro-angiocardiograms, while the levo-angiocardiogram may show indisputable signs of interauricular or interventricular communication. In both deformities one obtains a shadow which constitutes a complete mold of the heart. The greater the diameter of the septal defect, the more intense will be the opacification of the cardiac cavity. The fact that these defects are often associated with other malformations requires that interpretation of levo-angiocardiograms should be done with great care in order to evaluate the shadows obtained in the films.

Complete angiocardiographic exploration should include both a right and a left angiocardiogram. The latter has a decisive value in differentiating between aneurysm of the aorta and mediastinal tumor. In these cases the shadows are pathognomonic and admit no discussion. The authors insist on the importance of combining the levo- and the dextro-angiocardiographic findings with the clinical data and results of other investigations. JAMES T. CASE, M.D.

A New Indirect Radiologic Sign of Coarctation of the Aorta by Superior Retrograde Aortography. History of Its Discovery. Raúl Pereiras and Agustin Castellanos. Arch. de med. inf. (Habana) **15:** 78–97, April–June 1946.

On numerous occasions the authors have injected the humeral artery and by retrograde aortography have visualized the cardiac cavities in cadavers. This work was done in 1937 and published the following year. It was shown to be possible to produce in the living body radio-opacification of the greater part of the subclavian artery by making the injection centripetally from the axillary artery. The innocuousness of this technic has been demonstrated. Retrograde or countercurrent aortography was first employed clinically in the diagnosis of persistence of arteriovenous ducts, and in 1942 for establishing the diagnosis of coarctation of the aorta in young children. Recently in adult subjects and in older children and in adolescents, the authors have found that with retrograde aortography one may obtain radiographic visualization of the collateral circuation.

A very sharp trocar is employed, preferably a new one, after a little local infiltration with pantocain or novocaine. In a case of suspected coarctation of the aorta, the arterial tension in the upper extremities is markedly elevated, and this explains why the radio-opaque injection must be made with great force in order to overcome the resistance of the blood stream. Injection is made by direct puncture of the left humeral artery. A ligature, well tied, is placed below the site of the injection to prevent the radio-opaque material from being distributed centrifugally in the forearm and hand. The injections have been made manually, and in all cases the authors have succeeded in overcoming the resistance in the blood column, although sometimes with difficulty. The x-ray films have been exposed within 1/20 second. The amount of diodrast or neo-iopax used has been up to 20 c.c.

Several roentgenograms are published showing good visualization of the collateral circulation. The arteries are seen to be dilated not only in diameter but in length, and as a result there is formed at irregular intervals a series of loops which correspond to the site of erosion of the inferior border of the ribs. Since these vascular loops are animated by the intense movements of the systolic dilatation, they cause the erosion to which they refer.

These observations demonstrated that the costal notches are not simply the result of the arterial dilatation but of the formation of the arterial loops above mentioned. The erosion occurs only at the sites of the loops. The authors conclude that when by aortography these vascular whorls or loops are demonstrated, they may be considered an indirect sign of coarctation, even though rib notching has not yet become demonstrable. JAMES T. CASE, M.D.

Complete Occlusion of the Abdominal Aorta. Report of Two Patients Diagnosed by Aortography. Alison Howe Price and Frederick B. Wagner, Jr. Surg., Gynec. & Obst. **84:** 619–624, April 15, 1947.

The authors report 2 cases of complete occlusion of the abdominal aorta just distal to the renal arteries. A definite diagnosis was made during life by direct translumbar aortic injection of a radiopaque medium. The diagnosis was confirmed by operation in one case and at autopsy in the other. Reference is made to a previous article by one of the authors for the technic of the aortic injection (Wagner: J. Urol. **56:** 625, 1946. Abst. in Radiology **49:** 524, 1947).

VERN W. RITTER, M.D.

On the Technique of High Retrograde Arteriography in Circulatory Disturbances of the Lower Limbs. Matti Sulamaa. Acta radiol. **27:** 643–646, Dec. 20, 1946.

The author accomplishes visualization of the pelvic arteries by means of rapid injection of contrast medium into the femoral artery while a tight compression band is applied to the abdomen to compress the aorta. It is possible by this means to obtain filling as far as the bifurcation of the aorta and at times to the opposite side.

ELIZABETH A. CLARK, M.D.

Arteriovenous Fistula: Experimental Study of Influence of Sympathetic Nervous System on Development of Collateral Circulation. Ralph A. Deterling, Jr., Hiram E. Essex, and John M. Waugh. Surg., Gynec. & Obst. **84:** 629–641, April 15, 1947.

Establishment of adequate collateral circulation is necessary for the success of measures to eliminate arteriovenous fistulas. Standard procedure in the past has been to permit some time to elapse following the occurrence of the arteriovenous fistula to allow this collateral circulation to develop on a spontaneous basis. Precorrective sympathectomy has been spiritedly discussed as a means of enhancing the development of the collateral circulation and thus preventing the poor results which are frequently caused by chronic vascular deficiency and gangrene. The authors have conducted experiments to test the sympathectomy idea and conclude that precorrective sympathectomy does definitely contribute to the development of collateral circulation beyond that which might be expected to develop spontaneously with the passage of time. They therefore advise that this method be considered in all cases in which collateral circulation may be inadequate or in which vasospasm from operation would be disastrous. By such means they feel that early, safe repair of arteriovenous fistulas is possible.

Angiography played an important part in studying the circulation of their experimental animals.

PAUL W. EYLER, M.D.

Volume Elasticity of the Aorta in the Intact Dog. L. N. Katz, M. R. Malinow, B. Kondo, D. Feldman, and N. Grossman. Am. Heart J. **33:** 319–331, March 1947.

The large elastic arteries serve as conduits and as storage points for a portion of the blood ejected during systole. By this mechanism energy is accumulated during systole and released during diastole. A compression chamber is thus formed which helps to maintain a constant flow of blood into the peripheral vessels. The characteristics of the compression chamber play an important role in cardiovascular dynamics. The elasticity of its component parts is unequal.

Our present knowledge of the elastic properties of the large arteries has depended upon studies of isolated portions of vessels and upon indirect evidence involving measurements of pulse wave velocities and pressure pulses. The authors describe a new diodrast angiographic technic for the purpose of measuring the distensibility curve of the aorta in the living dog with the chest closed.

Seven dogs were used. That portion of the descending aorta selected for study was marked off with two small metal grids sewed onto the adventitia. Under fluoroscopic control two radiopaque catheters, 3.8 mm. in diameter, were introduced. One was passed by way of the left carotid artery into the upper part of the descending aorta. The other was introduced into the descending aorta by way of the left femoral artery until its tip lay equidistant between the two grids; it was then connected to a manometer to record the pressure pulse in the aortic segment under study. The other catheter was used to inject diodrast, for opacification of the aorta. X-ray exposures were made immediately after the injection of 20 c.c. of a 70 per cent solution. This was repeated a number of times without moving either the animal or the x-ray tube. The dogs were bled from time to time in order to obtain a wide range of arterial pressures for each animal. This procedure was repeated until the animal succumbed. Immediately after death the aorta was removed. The proximal portion was tied at the level of the upper grid. The distal portion was tied opposite the lower grid over a cannula attached to a syringe and a manometer. The aorta was filled with physiologic saline solution. Measured increments of saline were injected into the isolated aorta and the resulting pressure was measured.

Data were obtained which resulted in determination of volume of the descending aorta in the living dog, direct determination of distensibility, and pressure volume relationships. The observations are discussed, including the errors of the method.

HENRY K. TAYLOR, M.D.

TECHNIC

X-Ray Storage Properties of the Infrared [-Storing] Phosphors and Their Application to Radiography. O. E. Berg and H. F. Kaiser. J. Appl. Physics **18:** 343–347, April 1947.

An application of the characteristics of infra-red-storing phosphors to radiography is described, whereby the expense and trouble of processing x-ray film may be partially or completely eliminated. The properties of these materials of storing x-ray energy for periods of time and of releasing that energy upon exposure to infra-red radiation have proved practical for either temporary or permanent recording of the latent x-ray image. One feature of this method is the complete removal of x-radiation harmful to the x-ray technician. The possibility of a new field of radiography in "flash fluoroscopy" is also suggested. Graphs and charts exhibiting the characteristic behavior of infra-red-storing phosphors to x-ray energy are included, and photographs and radiographs to show comparison of radiography with phosphorography are reproduced.

[This author's abstract is reprinted from the *Monthly Abstract Bulletin* issued by the Kodak Research Laboratories (**33:** 256, July 1947).]

Adapter for Processing 70-mm. Roll Film in Open Tanks. A. J. Moen. Pub. Health Rep. **62:** 512–513, April 4, 1947.

An adapter which permits the development of the 70-mm. 100-foot film in a regular 10-gallon open tank, instead of the miniature film tank, is described, and a drawing illustrating its construction is included.

RADIOTHERAPY

Radiotherapy of Malignant Tumors in the USSR. Mikhail Pobedinski. Am. Rev. Soviet Med. **4:** 328–332, April 1947.

The author traces the development of radiotherapy of malignant tumors in the Soviet Union and the establishment of centers for radiation therapy. It is noteworthy that most of the advances have been made in institutions devoted to the treatment of cancer and not primarily limited to x-ray diagnosis and treatment.

Special mention is made of the work of Dillon, who treats pulmonary cancer by irradiation through many fields, exposing only a small part of each field at a time, and of the method of filterless intravaginal x-ray therapy developed in the x-ray department of the Obstetric-Gynecologic Institute of the Academy of Medical Sciences. This latter method is indicated in cancer of the cervix, especially of the exfoliative type, and in cancer of the vulva. Soft, unfiltered rays of 80–180 kv. are used, treatment being given through a cylindrical vaginal speculum, which limits the fields of exposure to 35–45 mm., and thus avoids appreciable harmful effects on adjacent tissues and organs. The dose may be as high as 40,000 r. Of 15 cases of histologically confirmed cancer thus treated, 5 were in the first stage and showed clinical recovery. Ten were in the second or third stage and were given in addition deep x-ray therapy. These cases showed considerable improvement, with scarring and reduction or complete disappearance of infiltration in the cellular tissues of the pelvis. Patients were kept under observation for twelve to fourteen months after treatment.

In the Soviet Union careful watch is kept over the health of specialists working under conditions which may be harmful. Physicians and other medical workers engaged in the use of radium work only twenty-four hours a week. They receive higher salaries and paid annual vacations of seven weeks. During the war, workers in this field received special high-calorie rations.

In order to provide adequate assistance to the general population a number of special x-ray and radiotherapy stations have been established in various districts and are staffed by qualified personnel. The following programs are carried out in these centers: (1) regular consultation services to roentgenologists, (2) the repair and setting up of x-ray therapy units (a special engineer is in charge of the technical bureau for this purpose), (3) the control of measuring instruments and standardization of dosage, (4) the supervision of preventive measures for the protection of the health of the workers in x-ray centers, (5) supervision of the quality of therapy rendered in these centers. The chief roentgenologist of the Ministry of Health is in charge of this organizational work. A radiologic commission controls the entire work of the Ministry of Health in this field.

Symposium—Industrial Skin Cancer, with Special Reference to Pitch and Tar Cancer. I. Hieger, S. A. Henry, P. Ross, and J. G. Winternitz. Brit. J. Radiol. **20:** 145–163, April 1947.

This Symposium on industrial skin cancer was opened by Hieger, who discussed the production of cancer in mice by carcinogenic hydrocarbons, as representing a

"simplified model of the action of pitch and tar on human skin." He made the following points, among others:

Industrial coal tars vary in their carcinogenic activity depending upon the amount of carcinogens they contain, chiefly derivatives of dibenzanthracene and benzpyrene. Small changes in the constitution of the chemicals produce wide variations in the carcinogenic potency. The amount of carcinogen required for the production of a tumor in the mouse following subcutaneous injection is small, of the order of 0.01 mg.

The mechanism of cancer production is a complete mystery. There is a latent period between the application of the carcinogen and the appearance of the tumor. After the passage of a considerable part of this latent period, epithelial cells of the skin increase in size and the epithelial layer becomes thickened. The collagen of the dermis changes more slowly, becoming rarefied and non-refractile; the subcutis becomes congested, but there is no infiltration of inflammatory cells.

There is evidence to show that, although only the carcinogens produce cancer, other substances act as sensitizing agents.

Henry described the first changes in persons exposed to the carcinogens found in tar and its products, including soot and pitch, as papillomatous or ketarotic growths, single or multiple. These may remain benign, and sometimes spontaneously disappear, or may eventually become malignant. Recurrences are frequent, even after removal of benign growths. Some malignant types may produce death from metastasis in two to three years.

A great variety of products used in a large number of industries may produce these cancers. The site depends in part upon the type of work and the personal habits of the worker. The exposed parts of the head and neck are commonly involved in fuel workers, tar distillers, road workers, coal gas workers, and purifiers of anthracene. The exposed parts of the upper limbs in makers of optical lenses, cable makers, net proofers, oil refiners, and coke oven workers. Covered parts, chiefly the scrotum, are affected in pitch loaders, gas factory workers, and coal carbonizers, as well as the classical chimney sweeps. A few cases have appeared in women in textile industries.

In most cases, the lesions appear after twenty to twenty-five years of exposure. The shortest period recorded in some 3,000 workers was eight months in a patent fuel worker. The maximum number of cases arise some twenty to twenty-four years after commencing work in pitch or tar and some fifty to fifty-four years after beginning work in shale oil or mineral oil.

Treatment was discussed by Winternitz. Surgery or radiation may be successful. At the Royal Cancer Hospital contact therapy is producing good results, with the least interference with normal routine. Of a total of 140 malignant lesions, 112 received fractionated treatment, 27 a single dose of x-rays, and one was treated with a radium applicator. Of the 112 lesions treated with fractionated x-ray treatment, 110 showed no signs of recurrence over a period extending from twelve months to eight years, while 2 failed to regress completely after the first planned treatment and were re-treated within two months. These 2 showed no sign of recurrence when last seen, one two years and one seventeen months after the last treatment. Out of the 27 malignant lesions treated with a single dose, 21 showed no recurrence over a period of twelve months to five years, while 6 required further irradiation. Four responded well to a second course of treatment. It is clear, the author believes, that with small superficial accessible tumors that are sent early for treatment, a 100 per cent cure rate should be obtained.

Ross' contribution to this symposium had to do with the types of neoplasms produced by pitch and tar and the degenerative lesions. It is presented in brief abstract form. SYDNEY J. HAWLEY, M.D.

Lymphosarcoma of the Larynx. Report of a Case. Melvin Schlemenson and Eduardo Caceres. Arch. Path. **43:** 393–395, April 1947.

A case of generalized lymphosarcoma with localization in the larynx is presented. This is the fifth case of lymphosarcoma of the larynx recorded in the literature and the only reported case of lymphosarcoma of the larynx with concomitant lymphatic leukemia. The lesion in the larynx showed complete regression and relief of symptoms following radium pack therapy (65,000 mg. hr. to each side of the neck).

Treatment of Carcinoma of the Uterine Cervix. Considerations on the Fiftieth Anniversary of the Wertheim Operation. Franz Buschke and Simeon T. Cantril. West. J. Surg. **55:** 152–161, March 1947.

The fundamental change from surgery to irradiation in the treatment of cervical carcinoma came in 1932, when Jean Louis Faure presented his results with radical surgery before the Paris Academy of Medicine and was challenged by the presentation of Regaud's results obtained by radiation therapy in the Institut Curie. Nowhere have the results accomplished by Regaud and his collaborators been excelled and only in a very few institutions have they been equaled, in spite of improvement of technical facilities and apparatus. This failure of duplication is probably due to too rigid standardization of treatment, with routine application of a so-called "standard technic" and without the necessary careful appraisal of the situation in the individual patient.

At the Tumor Institute of the Swedish Hospital in Seattle, from which this report comes, cervical carcinomas are classified clinically according to the League of Nations (1937) classification. Every case beyond Stage I is investigated by intravenous pyelography, since the demonstration of ureteral obstruction places a case that otherwise might be staged as II or III, in Stage IV, since prognosis is almost hopeless. Two fallacies in staging must be kept in mind: (1) the interpretation of an inflammatory parametrial infiltration as carcinomatous, and (2) the presence of carcinomatous nodes in higher portions of the pelvis beyond the reach of palpation. The first type of error may account for the occasional cures of apparently hopelessly advanced cases of extensive parametrial disease. The other fallacy probably accounts, at least in part, for failures in apparent Stage I cases.

Microscopic grading of carcinoma of the cervix is of limited value. However, care should be taken to distinguish adenocarcinomas and adeno-acanthomas, as these do not respond as satisfactorily to radiation therapy as the ordinary epidermoid carcinoma.

Following the experience of Regaud and Lacassagne, the authors attempt to give a total of 8,000 mg. hr., equally divided into 4,000 mg. hr. through a cervical tandem and 4,000 mg. hr. through paracervical applicators. The distribution of the dose varies according

to the individual findings. While the original procedure of the Curie Institute used simultaneous intracervical and intravaginal applications, these are now usually given in succession, with an interval of from three to eight days. In this way the dose is distributed over a period of two weeks or longer. The quantity is thereby increased without serious risk to the normal structures. In all but Stage I cases radium application is followed by a course of external roentgen therapy. During recent years the factors employed have been 800 kv., 10 ma., 4 mm. lead filtration and 100 cm. distance. The average total dose to all fields is 12,000 r, measured on the skin, in about six weeks.

Transvaginal x-ray therapy is used in selected cases, the main indication being a large ulcerated and infected growth in which a homogeneous irradiation by vaginal radium would be impossible because of the size or shape of the tumor. The patients are strictly under the care of the radiologist throughout. Vaginal examination is made at weekly intervals to judge the response of the disease, adjust the treatment, and anticipate complications, as a division of effort as is sometimes practised increases the risk of radiation damage. Five-year results are given for 130 cases treated up to 1940. The relative cure rates are as follows: Stage I, 83 per cent (5 cases out of 6); Stage II, 56 per cent (22 cases out of 39); Stage III, 38 per cent (26 cases out of 68). Three of 17 patients with Stage IV lesions were well after a five-year period.

In conclusion, it is pointed out that radiation therapy could be immeasurably improved if such terms as "pelvic cycle," "roentgen series," or naming of a particular technic could be omitted. Such terms point psychologically to standardization of treatment in a disease which should be considered from the point of view of individualization for the particular patient at hand.

ELLWOOD W. GODFREY, M.D.

Cancer of the Cervix Uteri—The Results of Treatment with Radium. R. G. Maliphant. J. Obst. & Gynaec. Brit. Emp. **54:** 155–163, April 1947.

The results of radium treatment in a series of 827 cases of cancer of the uterine cervix are presented. In 242 cases the interstitial method was used, and in 585 the two-application Stockholm technic. Twenty-nine per cent of the cancers were hypertrophic growths with or without cauliflower-like proliferation. In 55 per cent of these the most prominent feature was ulceration. Slightly over 4.3 per cent were adenocarcinomata, and the remainder were squamous-cell cancers (26 per cent spinal-cell type, 57.5 per cent transitional-cell type, and 12 per cent anaplastic spindle-cell cancers). Cornification was evident in 8.6 per cent of the cases.

Interstitial radium treatment showed a five-year salvage figure of 11 per cent. It was satisfactory only in cases in which the disease was limited to the cervix. With the two-application Stockholm technic, the absolute five-year survival rate was 25.2 per cent. Fifteen per cent of the patients surviving five years died of cancer during the succeeding five-year period and even ten-year survival after radiotherapy is not to be regarded as synonymous with cure.

The best results were obtained in the hypertrophic growths. They produce symptoms earlier than growths of an infiltrating nature but they have a more favorable prognosis, irrespective of the clinical stage of disease.

The prognosis in adenocarcinoma of the cervix is not so favorable as in squamous-cell cancer, in spite of the tendency of the former to develop as a hypertrophic or cauliflower growth. The best results were obtained in the more anaplastic squamous-cell carcinomas—the mid-ripe transitional-cell types and the unripe spindle-cell types.

The duration of symptoms was a poor index of the extent of the disease, and, therefore, of prognosis. The presence of pain does not invariably indicate advanced disease, but at all stages it has an adverse influence on the prognosis.

The survey again demonstrates the importance of early diagnosis; by far the most important factor controlling the permanence of cures is the extent of the carcinoma when treatment is instituted.

SYDNEY F. THOMAS, M.D.

Cancer of the Cervix. A Local Recurrence Eighteen Years After Radium Therapy. E. Eugene Covington. J. A. M. A. **133:** 935–936, March 29, 1947.

The local recurrence of a squamous-cell cancer of the cervix eighteen years after radium therapy (5,000 mg. hr.) is reported. As far as the author could determine from the literature, this case represents the longest interval of time on record before a local recurrence of a squamous-cell cancer. The recurrence was treated with 2,000 r (400 kv.) over each of four pelvic areas (two anterior and two posterior) over a period of four weeks, with a heavy Thoraeus filter, at 50 cm. distance. This was followed immediately by intrauterine and contracervical application of radium (3,600 mg. hr.). At the time of the report, two months after treatment, the general condition of the patient was good, the local growth had entirely disappeared, there was no evidence of metastasis, and the bleeding and discharge had stopped; the only complaint was mild diarrhea and rectal pain from irradiation proctitis and a slight stricture of the rectum.

The possibility that this was a new cancer developing in an irradiated cervix rather than a recurrence is mentioned.

Radiography as an Aid to Dose-Control in the Radium Treatment of the Cervix. M. H. E. Hulbert. J. Obst. & Gynec. Brit. Emp. **54:** 137–154, April 1947.

The actual text of this article comprises only four pages, the remainder being devoted to diagrams and roentgenograms which graphically illustrate how minor variations in the placement of radium in the cervix can significantly modify the dose distribution. The ingenious charts should be seen to appreciate the full weight of the paper. By putting diagrams and graphs side by side, the author makes it possible to obtain a three-dimensional view of the dosage at various points.

To assess the dosage and to guard against misplacement of radium, three radiographic methods are suggested:

(*a*) An anteroposterior and a lateral film. These, however, are difficult to interpret because of overlapping of dense shadows and because of the magnification distortion inherent in the method.

(*b*) Stereoscopic anteroposterior films. These give a good survey of the position of the containers but do not permit an accurate measurement of dimensions unless a mensuration stereoscope is used.

(*c*) A combination of *a* and *b*. For a scale drawing of the insertion in the coronal plane, the dimensions of the

central anteroposterior film are reduced to a natural size by the formula:

$$\text{True dimension} = \text{measured dimension} \times \frac{\text{Total stereo tube shift (T.T.S.)}}{\text{T.T.S. measured image shift}}$$

An exaggerated total tube shift (20 cm.) is employed so that the image shift on the films is easily measurable. Films thus obtained still permit stereoscopic visualization as an aid.

Radiographic control will also demonstrate the presence and degree of retroversion of the uterus.

Since radium therapy by the Stockholm method will rarely affect tumor tissue situated more than 3 cm. beyond the mid-line, supplementary external irradiation by x-rays is usually necessary. A plan of treatment is outlined using six fields and providing a roentgen dose that increases progressively as the radium dose falls off from the center of the pelvis toward the lateral wall.

SYDNEY F. THOMAS, M.D.

Leukemia (Summary of 100 Cases) and Lymphosarcoma Complicated by Pregnancy. Cellular Changes Produced in Guinea Pigs by Extracts of "Leukemic" Placenta. Lowell A. Erf. Am. J. Clin. Path. **17:** 268–280, April 1947.

An additional case of chronic myeloid leukemia complicated by pregnancy is reported. The patient received 52 transfusions during the last year of her life. The placenta from this patient showed slight infiltration with myeloid cells. A lipid extract of this placenta, injected into two guinea-pigs, produced myeloid-cell infiltrations in the organs, while injection of a similar extract of a normal placenta produced no abnormal cellular infiltrations in two control animals.

A second case of chronic myeloid leukemia, previously reported (Am. J. Obst. & Gynec. **48:** 125, 1944) is completed. The autopsy findings of a mother and two offspring are discussed. The parents had been first cousins. Both children died apparently of disturbances of the thermal center, possibly brought on by x-irradiation of the mother during pregnancy.

A brief analysis of 100 cases of leukemia complicated by pregnancy is presented. There were 87 cases of myeloid leukemia (24 acute, 63 chronic) and 13 of lymphoid leukemia (10 acute, 3 chronic). Less than 50 per cent of babies of mothers with acute leukemia are normal, while 75 per cent of babies whose mothers have chronic leukemia are normal.

An additional instance is also reported of lymphosarcoma complicated by pregnancy. In this case, the findings at biopsy were those of Hodgkin's disease, and at autopsy those of lymphosarcoma.

Chronic Lymphatic Leukemia. Radiation Therapy Conference. Lowell S. Goin. West. J. Surg. **55:** 253–254, April 1947.

An elderly white male, aged 74, entered the hospital for radiation therapy of a lymphatic leukemia on Oct. 22, 1942. At the time of the present report (February 1947), after four years and five months, he was in excellent condition, although the white count was rising. No associated anemia had developed. During this period three courses of roentgen therapy were given. Since there is almost no prospect of curing leukemia, in the author's opinion the objective must be the greatest palliation possible, and this is best obtained by carefully avoiding the temptation to treat the blood count or to carry treatment beyond the point of restoration of comfort and well-being. In other words, it seems likely that the blood count is of comparatively little significance if the patient is well, and that treatment should be aimed at the production of remissions and their continuance as long as possible rather than at the re-establishment of a theoretically normal count. Adjuvant therapy is of much importance. Blood transfusion, liver therapy, rest, maintenance of good diet, and vitamin therapy are all useful.

Use of Radium in the Treatment of Conductive Deafness. John E. Bordley. Surg., Gynec. & Obst. **84:** 839–844, April 15, 1947.

Irradiation with radium or radon is effective only in that type of conductive deafness which is due to obstruction of the pharyngeal end of the eustachian tube by lymphoid tissue, before fibrous fixation of the ossicles occurs. In selection of cases for treatment the importance of a careful history, otoscopic examination, nasopharyngoscopic examination, and hearing tests is emphasized. The variations of history and physical findings are discussed.

Of the sources of radiant energy, radium is to be preferred because it can be applied in high concentration without appreciable exposure of normal tissues. The action of radium is on the germinal centers of the lymphoid tissue; it also has a powerfully destructive effect upon the bacteria growing within the tissue.

The standard Army monel metal applicator is used in the author's clinic, and a series of three treatments at intervals of two weeks is given. The calculated dose is 25,000 milligram seconds. If the stainless steel radon gas applicator made by the Kelly Clinic is used, the dose is 17,000 millicurie seconds. With the latter applicator the proportion of beta rays is larger; hence the difference in calculation.

No serious reactions have been encountered with this procedure, and statistical studies have proved its efficacy. Best results have been obtained in children. Two illustrative cases are included.

ALTON S. HANSEN, M.D.

Radium Therapy to Nasopharynx for Peri-Tubal Lymphoid Tissue. John S. McMurray. Pennsylvania M. J. **50:** 606–608, March 1947.

This paper is a brief summary of the author's experience with radium for the control of aerotitis in the Army Air Force. In the Irradiation Clinic at the author's base, 4,283 men were examined in seven months for excess lymphoid tissue around the eustachian tubes. This excess tissue may become inflamed at high altitudes and cause obstruction of the tubal orifices. Radium treatment was given in 1,127 cases. The floor of the nasal vestibule was cocainized, and a special monel metal applicator, containing 50 mg. of radium, was introduced through each nostril so that the radium came to rest on the posterior wall of the nasopharynx, close to the eustachian orifice. The radium was held in place for eight minutes. A series of three treatments was given at twenty-five-day intervals.

In examining this group of flyers, the author found many cases in which the adenoid tissue had apparently returned after operation. There were a number of cases where marked scarring around the eustachian tubes had occurred secondary to adenoidectomy.

In civilian practice radium treatment is particularly

applicable to children where lymphoid tissue obstructs the tubal orifice and each succeeding upper respiratory attack results in a decrease of hearing.

JOSEPH T. DANZER, M.D.

Asthma in Children. Treatment with Radon Nasopharyngeal Applicator. Arthur T. Ward, Jr., Samuel Livingston, and Dean A. Moffat. J. A. M. A. **133:** 1060–1062, April 12, 1947.

The authors report on 34 cases of asthma in childhood treated by nasopharyngeal radon application. In 47 per cent of this group the tonsils and adenoids had previously been removed. All types of asthma were included and the cases were followed for six months to four years. The two prerequisites in case selection were that the child must have had recurrent attacks of asthma and that the nasopharynx must contain masses of adenoids or lymphoid tissue.

Detailed clinical work-ups were done on every patient from the otolaryngologic, allergic, and pediatric point of view. Treatment consisted in the application of 2 gram minutes of radon to each side of the nasopharynx once a month for an average of four treatments. In 44 per cent of the series complete relief of asthmatic attacks was obtained; 15 per cent were markedly relieved, having only occasional mild attacks, and in 9 per cent the frequency and severity of attacks were reduced by half; 32 per cent showed no benefit.

D. A. KOCH, M.D.
(University of Michigan)

Expression of Dosage in X-ray and Radium Therapy. Irvin F. Hummon, Jr. Illinois M. J. **91:** 132–134, March 1947.

One will rarely find a better summary of the expression of dosage than is contained in the three pages of this article. The author stresses the necessity of giving full details regarding x-ray or radium therapy to the end that the tumor dose delivered is accurately stated. He outlines the factors necessary to an accurate statement and adequate explanation of the amount and type of radiation administered. For x-ray therapy, these are: total minimum tumor dose; size and position of ports; total skin dose, including exit dose, if significant, received by each port; treatment factors (kv.p., filter, h.v.l., ma., time, air dose); number of ports treated per day, rate of protraction and fractionation. For radium the complete expression of dosage includes: minimum tumor dose, amount of radium used and time of application or number of mcd., filtration, and number, active length, strength and spatial distribution of the radioactive sources. These remarks on the necessity of full details in the statement of radium dosage are particularly pertinent and should be read and heeded by everyone using that agent. Use of the treatment record forms supplied by the Standardization Committee of the Radiological Society of North America is recommended.

ROBERT C. PENDERGRASS, M.D.

INJURIOUS EFFECTS

Perichondritis of the Larynx Secondary to Interstitial Application of Radium to the Thyroid Gland. Report of a Fatal Case. Francis H. McGovern. Ann. Otol., Rhin. & Laryng. **56:** 206–210, March 1947.

Laryngeal perichondritis occurs after direct trauma and may be secondary to certain acute and chronic infections; it may result from extension of inflammation of the oral cavity or occur after the use of nasal feeding tubes. It may also follow irradiation to the region of the larynx. The diagnosis is made from the history, the appearance of the larynx, and by palpation. The sequelae, stenosis and atresia of the larynx, chondral necrosis, and asphyxia are most serious. The stenosis is most severe when caused by irradiation.

A 32-year-old white woman was first admitted to the hospital in February 1944, at which time a diagnosis of toxic adenoma of the thyroid gland was made. For unrecorded reasons interstitial application of radium needles was advised. Through a necklace skin incision six 10-mg. radium needles were implanted into the thyroid gland and left in place forty-five hours, for a total dose of 2,700 mg. hr. Eight months after the radium application, the patient was again seen, complaining of hoarseness, some dyspnea, a productive cough, and severe pain in the right side of the neck radiating to her right ear. The skin over the thyroid gland was thickened and erythematous. The structures beneath were immovable and indurated but not tender to palpation. Direct and indirect laryngoscopic examination showed atrophic, reddened vocal cords; the subglottic area was edematous. The trachea contained a purulent exudate. Conservative treatment was followed by temporary relief, but two weeks later difficulty in breathing and hoarseness had increased and the erythema of the lower portion of the neck had extended down onto the anterior chest wall. Severe dyspnea suddenly developed and death occurred before the completion of an emergency tracheotomy.

Beneath the skin and the subcutaneous layer of scar tissue, the tissues were found to be necrotic, filled with small abscesses and foul smelling pus. The tracheal rings were soft; the tracheal lumen was dilated and filled with purulent material. Gross examination of the larynx showed posteriorly on the right side a large erosion of the lamina of the cricoid cartilage and the upper tracheal cartilages. This area, the size of a dime, was covered by a necrotic membrane. The most significant microscopic findings were the peculiar fibroblasts, the hyalinization of arterioles and the ectatic capillaries.

In this case an interval of seven months elapsed between the radium therapy and the onset of the laryngeal symptoms. Tissue damage has been known to occur as long as seven years after irradiation. In spite of modern technic, radionecrosis of the laryngeal cartilages will occasionally occur. Because of its seriousness, it deserves close observation and prompt treatment.

STEPHEN N. TAGER, M.D.

EXPERIMENTAL STUDIES

Mechanism of the Invasiveness of Cancer. Dale Rex Coman. Science **105:** 347–348, April 4, 1947.

This author reviews the mechanism of invasiveness of cancer and summarizes his experimental findings as depending upon three factors:

"(1) Decreased adhesiveness of cancer cells, dependent upon local calcium deficiency. Decreased adhesiveness facilitates the separation of cells from each other so that they become detached units." The experiments to prove this are very ingenious; separation of pairs of

cells was measured under the microscope by the amount of bend in micro-dissection needles.

"(2) Ameboid movement, by which the malignant cells are enabled to wander into the surrounding parts to establish new colonies."

"(3) Liberation of spreading factor (hyaluronidase) which acts upon adjacent normal tissues. Hydrolysis of the hyaluronic acid of the intercellular cement substance of connective tissue opens the tissue spaces for penetration by malignant cells. It is quite possible that this third factor is not requisite for invasive growth, but that when it does operate, it augments the facility with which invasion occurs."

The author believes that the first two factors are of great importance for invasive growth and he points out that normal cells, such as macrophages, polymorphonuclear leukocytes and lymphocytes, are all detached cells, rarely showing any mutual adhesiveness and all having great ameboid activity. He goes on to point out that the cancer cell possesses all these same attributes coupled with its capacity for unlimited proliferation.

SYDNEY F. THOMAS, M.D.

Remarks About the Application of the Betatron in Cancer Therapy. Henry Quastler. Illinois M. J. **91:** 119–121, March 1947.

The particular betatron discussed in this article produced roentgen rays of a peak energy of twenty million-electron-volts. These rays, according to depth dose measurements, show an increase in tissue dose for 3 to 4 cm. below the surface, due to secondary electrons. Once the peak dose is reached, the tissue dose falls off slowly. This decrease is due to distance rather than absorption. On the basis of these findings, the author states that two or more beams arranged to coincide in the tumor area would result in a large dose to the tumor and a very small dose to the adjacent tissues outside the tumor area.

Experiments with mice and bean seedlings in a presdwood phantom showed that the changes observed were comparable in every respect with those produced by 200-kv. x-rays. No startling difference in tissue reaction is therefore predicted when the effect of the betatron is compared with these high-voltage x-rays. Certain problems, such as diaphragm control of radiation from the betatron and protection of the operator, had not been definitely solved at the time this article was written.

The author seems to feel that the use of the betatron offers an opportunity to give a predetermined dose to a tumor area without dangerous doses to the surrounding tissues. He recognizes the fact, however, that the location of the bladder and rectum in relation to pelvic carcinoma will remain a limiting factor in betatron therapy. [Certainly many basic data must be accumulated before rays from this source can be safely used in treating patients.—R. C. P.]

ROBERT C. PENDERGRASS, M.D.

Inactivation of Chorionic Gonadotrophin by X-Rays. A. Hochman, R. Black, G. Goldhaber, and F. Sulman. J. Endocrinol. **5:** 99–102, April 1947.

A powdered preparation of chorionic gonadotropin (Korotrin), with a potency of 100,000 i.u. (=500,000 r.u.) per gram was dissolved in distilled water. A drop of this solution was placed on a hollowed glass slide, covered by a mica slip, and irradiated at 35 kv. and 15 ma. The x-ray intensity at the distance of the drop (3.4 cm.) was about 95,000 r.p.m. [r per minute?]. In low concentration (0.2 per cent), the gonadotropin was inactivated as shown by tests on infantile female rats. For a given concentration of hormone, the degree of inactivation depended on the x-ray dose. For a given x-ray dose, the degree of inactivation depended on the concentration of hormone in the irradiated solution. The same x-ray dose produced a greater percentage of inactivation at a low concentration of hormone than at a high concentration.

Addition of serum or serum proteins to the solvent (down to a concentration of 0.005 per cent) protected the gonadotropin from the action of x-rays. This finding is explained by the assumption that the inactivation effect in dilute solutions is largely an indirect action mediated by ionized water molecules.

Roentgen Treatment of Tuberculous Infected Guinea-Pigs. A Morphological Study. Ragnar Steinert and Jan Cammermeyer. Acta radiol. **27:** 573–584, Dec. 20, 1946.

Because of conflicting early reports on the effect of roentgen rays upon experimentally produced tuberculous infections, the authors have repeated the studies with careful dosage calculations made possible by modern tubes and measuring equipment. Guinea-pigs were inoculated with a dry preparation of tubercle bacilli, and irradiated and non-irradiated animals were studied at varying intervals after inoculation for distribution and extent of the tuberculous lesions grossly. Microscopically tissues were studied for the presence of collagenous connective tissue fibrils, argentophile fibrils, iron pigment, changes in the lymphocytes, metachromasia, and tubercle bacilli. Minor differences were observed early, but after the infection had been allowed to progress for as long as thirty-four days, these differences became less marked. Therefore, the authors conclude, in agreement with Ford (Radiology **9:** 235, 1927), that no appreciable effect upon the tuberculous process is obtained by means of roentgen irradiation in the doses given (100 r on the ninth, eleventh, and thirteenth day following inoculation). ELIZABETH A. CLARK, M.D.

Radio Iodine: Its Use as a Tool in the Study of Thyroid Physiology. Rulon W. Rawson and Janet W. McArthur. J. Clin. Endocrinol. **7:** 235–263, April 1947.

This paper is essentially a review of studies of thyroid physiology with radioactive iodine, with sections on the collection of iodine by the thyroid and the effect of the thyrotropic hormone, the chemical transformation of administered radioactive iodine, the effect of certain thyroid inhibitors on the metabolism of iodine, the use of radio-iodine in the study of human thyroid disease, the treatment of hyperthyroidism with radioactive iodine, and the collection of radioactive iodine by thyroid tumors. The authors believe that the knowledge of iodine metabolism in Graves' disease has been advanced. Some correlation between the structure and function of benign and malignant tumors of the thyroid has been indicated. In adequate dosage radioactive iodine has proved to be a therapeutic agent of value in certain selected cases of hyperthyroidism and in exceptional instances of thyroid tumor. A bibliography of 78 references is appended.